Ventura County Air Pollution Control District
STAFF REPORT - August 31, 1999

RULE 74.11.1

LARGE WATER HEATERS AND SMALL BOILERS

BACKGROUND

The specifications for proposed Rule 74.11.1 originated in the 1987 Ventura County Air Quality Management Plan (AQMP) as Oxides of Nitrogen (NOx) Control Measure N-19 (Natural Gas Fired Commercial Water Heaters). The measure required all units sold in Ventura County to meet an emission limit of 40 nanograms of NOx per joule of heat output (ng/j). NOx emissions were estimated at about 0.04 tons per day, with an estimated reduction of 0.01 tons per day. The proposed adoption date was July 1, 1991, with an implementation date of July 1, 1992.

The control measure N-19 was carried forward to the 1991 AQMP as Control Measure N-102 (Boilers, Steam Generators and Water and Process Heaters Less Than 1 MMBtu's in Size). This measure was a consolidation of 1987 measure N-10 (Residential Water Heaters, implemented in 1986) and N-19. The proposed emission limit for both residential size and larger units remained at 40 ng/j. The large unit rule was scheduled for adoption on October 31, 1992, with an implementation date of October 31, 1993.

Control Measure N-102 was once again carried forward to the 1994 AQMP. No change was made to the requirements. The large unit rule adoption schedule was revised to March, 1995, with an implementation date of June, 1995.

Staff felt that a key requirement in developing this control measure was concurrent development in the South Coast Air Quality Management District (SCAQMD). Since N-102 creates a new market for low-NOx water heating equipment, it was felt that the market created by both SCAQMD and Ventura County would be more viable than a market in Ventura alone. SCAQMD rule development on this issue did not begin until 1996, with Rule 1146.2 adopted on December 12, 1997. District staff participated in the SCAQMD rule development process and began local rule development in early 1997.

In mid-1998, staff made the decision to expand the applicability of the proposed rule to units with an input capacity of up to 2,000,000 BTU/hr. This was done to further the similarity between the proposed rule and SCAQMD Rule 1146.2. Rule 74.15.1 already requires units between 1,000,000 BTU/hr and 2,000,000 BTU/hr to meet a NOx limit of 30 ppm; however, that rule applies primarily to existing units. Proposed Rule 74.11.1 will apply to new units only. Staff believes that, since both rules require a NOx limit of 30 ppmv, no conflict will occur.

In a related matter, the SCAQMD began work in 1995 on Rule 2506, Area Source Credits. The rule was adopted on April 11, 1997, and provides emission reduction credits to area sources that control emissions beyond that required in SCAQMD rules. 1997 Ventura County AQMP Further Study Control Measure N-112 contains a similar concept. Since commercial water heaters and small boilers do not require APCD permits, they qualify as area sources. As an alternative, N-112 proposes a 20 ppm NOx limit for all new and existing units.

Staff followed the development of SCAQMD Rule 2506 as a substitute for a specific large water heater and small boiler rule. Staff abandoned consideration of the concept when SCAQMD began the development of Rule 1146.2. Since Rule 1146.2 does not require a 20 ppm NOx limit for either new or existing equipment, a large market for 20 ppm low-NOx equipment will not be developed in the SCAQMD. Such a market would be critical for the success of 20 ppm rule in Ventura County. Therefore, staff recommends the rejection of Further Study Control Measure N-112 as infeasible.

Existing Rules

Rule 74.11 requires natural gas water heaters under 75,000 BTU/hr to be pre-certified to an emission level of 40 ng/j. Rule 74.15.1 requires boilers, steam generators, and process heaters sized between 1,000,000 BTU/hr and 5,000,000 BTU/hr, with

Table 1
Selected Users of Large Water Heaters
and Small Boilers In Ventura County
District/Gas Company Count Comparison

Classification	Gas Company	District Info a) P/O +	Survey =	Total
Universities, Junior Colleges	72	4	19	23
Elementary and Secondary Schools	204	19	204	223
Dry Cleaning Plants	184	99	-	99
Coin-Operated Laundries	152	0	32	32
Hotel & Motels	109	5	96	101

a) - Permit (P/O) duplicates were deleted from survey results.

annual heat inputs greater than 18,000 therms per year, to meet an emission level of 30 ppm of NOx and 400 ppm carbon monoxide (at 3 percent oxygen). Rule 74.15 regulates units over 5,000,000 BTU/hr in size. Currently, water heaters and boilers between 75,000 and 1,000,000 BTU/hr are subject to neither permit nor NOx control requirements; proposed Rule 74.11.1 will address NOx control on such equipment.

Equipment Users

Large water heaters and small boilers are used to either heat water or create steam for a variety of purposes. According to data received from the Gas Company in October, 1997, county users represent a wide variety of Standard Industrial Classification (SIC) codes. Leading the list are schools, laundry/ dry-cleaning establishments, hotels and restaurants; the complete list appears in Appendix A. Rule 74.11.1 may effect these and other source types because, after the final compliance dates, only low-NOx large water heaters will be sold in Ventura County.

According to other Gas Company data received in December, 1996, there are a total of 1819 units between 75,000 and 1,000,000 BTU/hr in Ventura County (see Appendix B). The 10/97 Gas Company data provides detailed information on 633 of those units. To check the number of equipment users, staff did a telephone book survey of schools, laundries and hotel/motels. Since dry cleaners are permitted by the District for VOC emissions, a permit count was obtained. The 10/97 Gas Company count is factored up by 187.3 percent (1-1819/633) to reflect the 12/96 count. The results appear in Table 1.

The survey results are fairly conclusive. Gas Company data overestimates both dry cleaners and laundries by a considerable amount (336/131). In addition, the count for universities and junior colleges are about three times the District count. However, the elementary/secondary school and hotels/motel totals are very close to the District totals. It is possible that the phone book survey, which was somewhat informal, did not include all sources.

During the development of Control Measure N-102 in 1985, the Gas Company estimated the county population over 75,000 BTU/hr at 4,200[3]. Nevertheless, based on the survey, staff feels that the 12/96 estimate of 1819 units between 75,000 and 1,000,000 BTU/hr in Ventura County is accurate.

109 boilers from 1,000,000 through 2,000,000 BTU/hr are permitted in Ventura County; a list of these sources appears in Appendices C and D. With these, the final estimate of existing applicable sources in Ventura County is 1928.

PROPOSED RULE

Each section of the proposed rule is discussed below. The format is based on existing VCAPCD Rule 74.11; the emission limits and certification requirements are from SCAQMD Rule 1146.2.

Section A, Applicability, specifies that proposed Rule 74.11.1 is a point-of-sale rule; applying only to new units. As such, the rule does not cover the sale or installation of either used or rebuilt units. Modified existing units are also not covered. By limiting applicability to persons "selling, offering for sale, or installing" new units, emission reductions will occur slowly over time as new installations are constructed or old units are replaced. Note that the rule does <u>not</u> exempt units used in residential dwellings. Staff

believes that all units in the applicable size range should comply with the rule, regardless of use.

A. Applicability

The provisions of this rule shall apply to any person selling, offering for sale, or installing a new water heater, boiler, steam generator or process heater with a rated heat input capacity greater than 75,000 BTU/hr and less than or equal to 2,000,000 BTU/hr in Ventura County.

As noted above, in order to create a market for low NOx water heaters and small boilers that is as broad as possible, the emission limits recommended for Rule 74.11.1 are the same as those in SCAQMD Rule 1146.2. The size divisions are the same as well. While not identical, the final compliance dates are within one day of each other.

B. Requirements

1. After December 31, 2000, a person shall not sell, offer for sale, or install in Ventura County any new unit with a rated heat input capacity of greater than or equal to 75,000 BTU/hr and less than or equal to 400,000 BTU/hr that does not meet the following criteria:

a. Oxides of nitrogen emissions shall not exceed 40 nanograms per joule of heat output (93 pounds per billion BTU), or 55 parts per million, and

b. The unit is certified in accordance with Section C.

2. After December 31, 1999, a person shall not sell, offer for sale, or install in Ventura County any new unit with a rated heat input capacity of greater than 400,000 BTU/hr and less than or equal to 2,000,000 BTU/hr that does not meet the following criteria:

a. Oxides of nitrogen emissions shall not exceed 30 parts per million and carbon monoxide emissions shall not exceed 400 parts per million, and

b. The unit is certified in accordance with Section C.

Parts per million (PPM) measurements are by volume and made at three percent oxygen on a dry basis. This specification appears in Subsection E.2.

There may appear to be a discrepancy between the 40 ng/j NOx limit in Subsection B.1 and the 55 ppm limit. While 40 ng/j is equal to about 78 ppm at 100 percent efficiency, concentrations are reduced at lesser efficiencies. SCAQMD used both limits in Rule 1146.2 to reflect both the efficiency benefit of a ng/j limit and the relative difficulty of determining ng/j, which requires both an emission and energy measurement.

The certification process in Section C is intended to mirror the SCAQMD process. Indeed, we intend to accept SCAQMD certifications in Ventura County; it is not our intention to require manufacturers to perform the certification procedure twice. However, certification reports for any model proposed for sale in Ventura County must be on file with the District 30 days before the date of sale. To insure the validity of a source test relative to units being manufactured, tests shall be conducted no more than 90 days prior to the date of proposed sale in Ventura County. Note that the "date of proposed sale" need not be the final compliance dates in Subsections B.1 and B.2.

C. Certification

Every subject unit offered for sale in Ventura County shall be certified by the Air Pollution Control Officer. On or before the applicable compliance date specified in Subsections B.1 or B.2, and thereafter at least 30 days prior to the date of proposed sale in Ventura County, the manufacturer shall submit a compliance report for each applicable new or modified unit by model. Certification shall be valid for three (3) years from the date of written approval by the Air Pollution Control Officer.

1. For each model certified, the manufacturer shall obtain from an independent testing laboratory a certification source test verifying compliance with the emission limits in Section B. Source tests shall be conducted on a randomly selected unit no more than 90 days prior to the date of proposed sale of the model in Ventura County. Tests shall be conducted and reports shall be prepared according to Attachment A of this rule.

2. The compliance report shall contain the following information:

a. General Information

1) Name and address of manufacturer,
2) Brand name,

3) Model number, as it appears on the permanent nameplate, and

4) Description of the model being certified, including burner type and rated heat input capacity.

b. A report on the source test specified in Subsection C.1.

c. A signed and dated statement attesting to the accuracy of all statements and information in the Compliance Report.

Any model certified for sale in Ventura County must be marked as such. It is important for a purchaser to easily identify complying units. As stated in Section D, the certification status of a unit must appear on the unit's permanent nameplate. If the nameplate is clearly visible through the packaging, no other markings are necessary. If the nameplate is not visible, the certification status must appear on the packaging. Model numbers must also appear. We will assume that any unit offered for sale without the necessary certification status declaration is non-complying.

D. Identification of Complying Water Heaters

The manufacturer shall display both the model number and the certification status, as determined in Section C of this rule, of an applicable unit on the permanent nameplate. If the permanent nameplate is obscured by packaging, the model number and certification status shall also appear on the packaging.

As stated in Section E, the District may require field source tests on units stocked by local distributors, retailers, and installers. These tests are not limited to units without a certification status declaration; a test may be requested on any unit. All testing shall be done at the manufacturer, distributor, retailer, or installer's expense. With a certification process in place, few fields source tests are expected.

E. Enforcement

1. The APCO may periodically inspect distributors, retailers, and installers of water heaters located in the District and require such tests as are deemed necessary to ensure compliance with the provisions of this rule.

2. Oxides of nitrogen emissions are measured as nitrogen dioxide using CARB Method 100. Parts per million measurements are by volume and referenced to three (3) percent stack gas oxygen on a dry basis. Field emission tests shall be conducted on units fired at maximum rated capacity, or as near thereto as practicable.

The definitions in Section F come from a variety of sources. The definitions of "boiler, steam generator," "process heater" and "rated heat input capacity" are from District Rule 74.15.1. However, "rated heat input capacity" does not include the derating provision in Rule 74.15.1. This provision was removed because it does not make sense to allow derating in a rule that regulates new units as small as 75,000 BTU/hr. The definition of "heat output" is similar to one appearing in SCAQMD Rule 1121.

The "water heater" definition is drawn from both Rule 74.11 and SCAQMD Rule 1146.2 [(b)(22)]. The first sentence is from Rule 74.11. The remainder of the definition describes the process in greater detail. To insure that the definition applies to all heaters, including "instantaneous" units, the words "closed vessel" have been removed. The definition of "unit" is from both Rule 1146.2 and Rule 74.15.1.

F. Definitions

For the purposes of this rule the following definitions shall apply:

1. "Boiler, Steam Generator": Any external combustion equipment fired with liquid and/or gaseous fuel and used to produce either steam or hot water. These terms do not include any unfired waste heat recovery boiler that is used to recover sensible heat from a combustion device.

2. "Heat output": The product H_0 as defined in Section 9.3 of the South Coast Air Quality Management District *Protocol* cited in Attachment A.

3. "Process Heater": Any external combustion equipment fired with liquid and/or gaseous fuel and which transfers heat from combustion gases to water or process streams. Process Heater does not include any kiln or oven used for drying, baking, cooking, calcinating or vitrifying or any fuel-fired degreasing or metal finishing equipment.

4. "Rated Heat Input Capacity": The gross heat input capacity specified on the nameplate of either the unit or the burner.

5. "Unit": A water heater, boiler, steam generator or process heater.

6. "Water heater": A device that heats water at a thermostatically-controlled temperature for delivery on demand. Water is heated by the combustion of either liquid and/or gaseous fuel and withdrawn for use external to the vessel at pressures not exceeding 160 psig. The device includes the apparatus by which heat is generated and all controls and equipment necessary to prevent water temperatures from exceeding 210^{o}F (99^{o}C).

Subsection C.1 states that each manufacturer shall obtain from an independent testing laboratory a certification source test verifying compliance with the emission limits in Section B. To ensure the greatest possible consistency between SCAQMD and District certification requirements, the SCAQMD test protocol is referenced in Attachment A to proposed Rule 74.11.1. All necessary source testing requirements are included in this protocol.

Attachment A, Certification Source Tests

Certification source tests, as specified in Subsection C.1, shall be conducted according to "*Nitrogen Oxides Emissions Compliance Testing for Natural Gas-Fired Water Heaters and Small Boilers*," Protocol, South Coast Air Quality Management District, Source Testing and Engineering Branch, Applied Science and Technology.

CONTROL TECHNOLOGIES

NOx emission reduction technologies generally focus on the pollutants generated during fuel combustion. While this is an important part of the rule development process, other techniques are available to reduce emissions from large water heaters and small boilers. These include electric water heaters, heat recovery water heaters and heat pump water heaters. Heat recovery units use waste heat and emit no air pollution. The only emissions associated with electric water heaters and heat pumps are those generated at the utility power plant. All three technologies are discussed in this report.

Gas-fired Equipment

Two types of burners are used in large gas-fired water heaters and small boilers in the 75,000 to 2,000,000 BTU/hr size range; they are either "forced-draft" or "atmospheric." Atmospheric burners use the motion created by the combustion of fuel and air to transfer heat to confined water; this is called natural draft[4]. Forced-draft burners use a fan or blower to move either air alone or an air and fuel mixture through the combustion chamber; this enables careful control of the amount of air in the system[5]. In both cases, the heat of combustion is transferred to water circulating through either a nearby jacket or a series of tubes.

Atmospheric units are simpler and less expensive than forced-draft units. However, thermal efficiencies are much lower. (Thermal efficiency is the ratio of heat contained in the natural gas to the amount of heat absorbed by the circulating water). The thermal efficiency of new atmospheric units range from 75 to 82 percent; new forced-draft units are typically 83 to 94 percent efficient. Despite the potential fuel savings, most units currently in use in California are believed to be atmospheric.

Units less than 300,000 BTU/hr are generally "tank-type" units. They resemble large residential water heaters and are used for a similar purpose - to heat potable water. Water is circulated through an upright tank shaped like a cylindrical ring, with hot combustion gases flowing vertically upward through the ring. The burners on these units are usually atmospheric[6].

Units greater than 300,000 BTU/hr heat input usually resemble small boilers. Because water circulates through a series of tubes or water jackets, they are referred to as "water-tube" boilers. The tubes are placed close to the flow of hot combustion gases and are heated as the gases flow around them. Burners on these units can be either atmospheric or forced-draft.

Table 2
Partial Listing of Manufacturers Currently Offering
Gas-fired Low-NOx Small Boilers

Manufacturer	Model	Size Range (BTU/hr)	NOx Emissions
Ace	"B" Premix (Atms)	200,000 - 1,500,000	<40 ng/j
Ajax	Low NOx Premix	150,000 - 2,000,000	< 20 ppm
A. O. Smith / Burkay	Legend 2000	500,000 - 1,000,000	20 – 40 ppm
Fulton	Vertical Tubeless	300,000 - 2,000,000	< 20 ppm
Glow Core	GB & GWH Series	40,000 - 160,000	3.0 – 15 ppm
Heat Transfer Products	Voyager	90,000 – 199,000	Low Emissions
Lochinvar	Copper Fin II	150,000 - 2,070,000	< 10 ppm
Lochinvar	"Residential" (Atms)	30,000 – 88,000	< 40 ng/j
Monitor Products, Inc.	MZ Series Hydronic	94,000 – 142,500	Low-NOx
Parker	Premix Metal Fiber	398,000 - 1,995,000	< 20 ppm
PVI Industries	Maxim Power	140,000 - 400,000	< 40 ng/j
Quickwater		500,000 - 1,500,000	< 20 ppm
RBI	Futura / Futura II	65,000 - 2,000,000	< 10 ppm
Sellers Engineering	8400	418,000 - 2,092,000	< 20 ppm
Teledyne Laars	Mighty Max	320,000 - 1,000,000	< 20 ppm
Thermal Solutions	Evolution	250,000 - 2,000,000	< 10 ppm
Weben Jarco	Vision 3000	500,000 - 1,000,000	< 10 ppm

Low-NOx Burners

The technology to reduce NOx emissions from gas-fired units in this size range is available now. Residential atmospheric water heaters have been meeting the proposed 40 ng/j NOx limit in Ventura County since 1986. Many manufacturers, particularly those located in Southern California, offer small boilers and process heaters with low-NOx forced-draft burners. NOx emission guarantees as low as 9.9 ppm are available, substantially less than the proposed 55 and 30 ppm limits. A partial listing of manufacturers currently offering low-NOx units appears in Table 2.

Forced-draft Low-NOx Burners

Forced-draft low-NOx burners limit NOx emissions by reducing the amount of air in the burner. A fan or blower controls the air available and provides better mixing of the air and fuel. This allows more complete combustion and lower flame temperatures. For example, by decreasing excess oxygen from 7 percent to 2 percent, NOx emissions can be reduced by 46 percent[5].

Reducing excess air also increases thermal efficiency. For example, a reduction in excess air from 40 percent to 10 percent (roughly equivalent to a reduction in oxygen from 7 percent to 2 percent), at a stack temperature of 350° F, improves thermal efficiency by about 1.5 percent[7].

The two primary low-NOx burner designs are (1) forced-air low-NOx, and (2) power premix. In forced-air low-NOx burners, air is blown in separately from the fuel and mixed inside the burner. Since excess air is tightly controlled, the amount of air immediately adjacent to the flame is limited. This results in lower peak flame temperatures and less NOx without compromising combustion integrity[8].

In the power premix design, air and fuel are mixed external to the burner. A fan is used to push a controlled amount of air through an airway as natural gas is mixed in, providing the burner with a uniform air/fuel mixture. Combustion occurs on a porous substrate that is either a supported matrix (metal or ceramic) or perforated ceramic tile. The substrate stabilizes the flame, controls the amount of air available, and, by distributing the flame across a broad surface, lowers peak flame temperature. The result is lower NOx emissions[8].

Atmospheric Low-NOx Burners

There are several atmospheric burner technologies available to meet the proposed 40 ng/j NOx limit: radiant, two-stage, non-aerated, ribbon and premix. These technologies work by limiting peak flame temperature and reducing the amount of air flowing to the burner. There is every reason to believe that many of these technologies will work well on larger equipment. Two manufacturers are currently marketing low-NOx atmospheric burners.

While the emission reduction and increased efficiency examples for forced-draft burners are notable, the examples for atmospheric burners are dramatic. Many atmospheric burners operate at over 100 percent excess air. By reducing excess air from 110 percent to 10 percent, at a stack temperature of 350° F, thermal efficiency increases by 5 percent. This can result in a fuel savings of 10-20 percent[7].

Alternative Equipment

As an alternative to gas-fired water heaters, staff looked into electric water heaters, heat recovery water heaters and heat pumps. Electric water heaters are available in sizes comparable to gas-fired units and are generally "tank-type" units, with electric coils or rods substituting for vertical burners inside the cylindrical tank. Electric water heaters create emissions in minor amounts indirectly through electric power generation.

Heat recovery water heaters can be designed to use no additional energy and create no emissions. In other situations, they are used to augment other water heating systems. These units resemble boilers, with water circulating through tubes subject to an existing heat source. Such heat sources can be, but are not limited to, air conditioning, refrigeration or food-processing units.

Heat pump water heaters extract heat from the ambient air, upgrade it with a compressor and refrigerant system, and transfer it to potable water. The system also creates cool, dry air that can supplement an air conditioning system[9]. Heat pumps also create emissions indirectly through the use of electricity. The cost-effectiveness of electric water heaters, heat pump water heaters and heat recovery water heaters is discussed below.

EMISSIONS

Using the population estimate for units between 75,000 and 1,000,000 BTU/hr noted above, uncontrolled emissions have been estimated using actual fuel use information and average emission rates. Tank-type water heaters and small water tube boilers have different uncontrolled emission rates. As noted above, the assumed cut-off point is 300,000 BTU/hr. For the smaller units, staff is using the uncontrolled emission rate from the SCAQMD Rule 1121 staff report; 74 nanograms per joule, or 0.137 Lb/MMBtu. This estimate was also used in the development of Rule 74.11. Staff estimates that there are 1244 units between 75,000 and 300,000 BTU/hr in the county.

For units above 300,000 BTU/hr, an emission rate of 0.17 Lb/MMBtu is used. This estimate is based on SCAQMD interviews with boiler manufacturers, data from the SCAQMD Rule 1146.1 staff report, and data gathered during the development of District Rule 74.15.1. Controlled emissions are based on either the proposed limits or manufacturer's claims. A summary of the results appears in Table 3. Staff estimates that there are 575 units between 300,000 and 1,000,000 BTU/hr in the county.

Fuel use is estimated using the Gas Company's 12/96 annual natural gas figures for units under 1,000,000 BTU/hr; see Appendix B. Using these numbers, total NOx emissions from commercial water heaters and very small boilers in Ventura County is 0.13 tons per day, or 48.5 tons per year.

Table 3
Emission Factor Data
And Assumptions

	NOx Emission Rate	
	PPM	Lb/MMBtu
Manufacturers' Data	100-180	0.12 - 0.22
SCAQMD Rule 1146.1	165	0.2
VCAPCD Rule 74.15.1	165	0.2
Uncontrolled ≤ 300,000	115	0.137
Uncontrolled ≥ 300,000	143	0.17
Low-NOx ≤ 400,000	55	0.065
Low-NOx Any Size	30	0.035
Low-NOx Any Size	9.9	0.012

Note that emissions from units between 1,000,000 and 2,000,000 BTU/hr are not included in the total NOx estimate. Since new units in this size range are already required by Rule 26 to utilize Best Available Control Technology (BACT), and existing units are required by Rule 74.15.1 to meet the proposed 30 ppmv limit, no new emission reductions for these units will occur as a result of Rule 74.11.1.

Emissions Reduced

To estimate emissions reduced, the size division point must be adjusted to 400,000 BTU/hr. Using the Gas Company's 12/96 population estimate, 78.2 percent of

units are under 400,000 BTU/hr and 21.8 percent are equal to or larger than 400,000 BTU/hr.

As noted above, the two size ranges will have different emission limits. The emission estimate uncontrolled tank-type units (0.137 lb/MMBTU) equals about 115 ppm. With tank-type units reduced to 55 ppm NOx, the expected reduction for the small units is about 52 percent (1-55/115). The large-unit uncontrolled emission estimate (0.170 lb/MMBTU) equals about 143 ppm. With a reduction to 30 ppm NOx, emissions will be reduced by about 79 percent (1-30/143). Consequently, the overall estimated NOx emission reduction will be 0.09 tons per day, or 32.0 tons per year. This surpasses the emission reduction estimate of 0.06 tons per day in AQMP Control Measure N-102. Note that the reduction will occur gradually over at least 10 years.

COST-EFFECTIVENESS

As noted above, applicable low-NOx units are available from a number of manufacturers. So far, most low-NOx units currently on the market are forced draft; most existing units are atmospheric. While the difference in cost between the two water heater designs will be addressed, the difference between similarly designed standard and low-NOx units is also discussed.

To make the calculations, various assumptions were made. Many of these assumptions are summarized in Table 4. The capital recovery factor, used to annualize the capital cost of the equipment, is based on a 10 year life at 8 percent interest, although small boilers can last up to 20 years. The cost of natural gas is based on a current residential bill. Emission rates are noted above.

Table 4
Assumptions for
Cost-Effectiveness Calculations

Fuel Cost = $0.521 per therm
Fuel Savings for forced-draft = 10 percent
Capacity Factor = 12 percent (0.12)
Capital Recovery Factor = 0.149

In general, forced-draft boilers have higher thermal efficiencies than atmospheric units; low-NOx forced-draft units are often even more efficient. In the staff report for District Rule 74.15.1, fuel savings for retrofit forced-draft burners was estimated at 13.4 percent; other estimates are as high as 20 percent. New and replacement large forced-draft water heaters are expected to experience similar savings. For these calculations, the fuel savings when using a low-NOx forced-draft unit in place of an atmospheric unit is estimated at 10 percent.

Additionally, in cases where a forced-draft unit over 300,000 BTU/hr replaced an atmospheric unit, SCAQMD included the cost of a $300 annual boiler tune-up. Since forced-draft units can be adjusted for peak performance, this seemed reasonable. However, SCAQMD included this cost in response to a specific type of high-maintenance burner. In addition, the Gas Company currently provides its commercial and industrial customers with free annual boiler maintenance. These checkups are done on both forced-draft and atmospheric units; the atmospheric units are disassembled and cleaned rather than adjusted.[10] For these reasons, staff has chosen to omit the annual maintenance expense for new forced-draft units.

An average capacity factor estimate was also made. The capacity factor is a measure of how much a unit (or a group of units) is used. It is based on actual annual fuel use divided by theoretical maximum annual fuel use. Using information from a survey, SCAQMD estimated a South-Coast district-wide capacity factor of 21 percent (0.21). In comments to SCAQMD, the Gas Company suggested that a more reasonable estimate, based on 2300 boilers, is 11 percent (0.11). Using fuel use and capacity information for the 633 units listed in the Gas Company's Ventura County data, the county-wide capacity factor for the subject units is estimated at 12 percent.

Equipment prices were obtained for new standard (uncontrolled) and low-NOx units from manufacturers and distributors. So far, all standard units priced are atmospheric and all low-NOx units priced are forced-draft. To illustrate the difference in cost between low-NOx forced-draft units and standard units, staff compared the average price of these units for different sizes ranges (see Table 6). Most of the average low-NOx prices are significantly higher than the average standard prices.

So far, most of the low-NOx forced-draft units considered are extremely low-NOx (under 20 ppmv). Since the emission limit for units under 400,000 BTU/hr is 40 ng/j, it is not necessary for operators to buy extremely low-NOx units. However, staff has discovered only two manufacturers currently

Table 5
Results of Cost-Effectiveness Calculations

Size (BTU/hr)	Description	Annual Cost ($)	NOx Reduced (Tons/Year)	Cost Effectiveness ($/Ton Reduced)
135,000	Atmospheric>Forced-draft Gas	89	0.009	9,889
150,000	Atmospheric>Atmospheric Gas	32	0.006	5,333
300,000	Atmospheric>Forced-draft Gas	188	0.020	9,400
400,000	Forced-draft>Forced-draft Gas	375	0.028	13,393
500,000	Atmospheric>Forced-draft Gas	236	0.025	9,440
750,000	Atmospheric>Forced-draft Gas	586	0.062	9,452
90,000	Atmospheric Gas-fired>Electric	1,258	0.006	209,667
1,000,000	Forced-draft Gas-fired>Electric	16,110	0.089	181,011
90,000	Atmospheric>Heat Recovery	(-) 296	0.006	(-) 49,333
350,000	Forced-draft>Heat Recovery+Gas-fired	(-) 561	0.025	(-) 22,440
400,000	Forced-draft>Heat Recovery	(-) 1,742	0.036	(-) 48,389
750,000	Atmospheric>Heat Recovery	(-) 2,467	0.067	(-) 36,821

marketing a 40 ng/j low-NOx atmospheric unit. Nevertheless, there is every reason to believe that other manufacturers will use the atmospheric burner designs currently in use on residential tank-type units to control large water heaters of significant size. Complying units are expected to be available by the proposed compliance date of December 31, 2000.

Table 6
Average Cost Comparison
For Gas-fired Equipment

Size Range (BTU/hr)	Standard Cost ($)	Low-NOx Cost ($)	Difference (Percent)
90,000-125,000	*1,412*	**3,305**	+134.1
130,000-165,000	*2,129*	**4,691**	+120.3
190,000-270,000	*3,154*	**4,941**	+56.7
300,000-418,000	*3,533*	**4,947**	+40.0
500,000-625,000	*4,356*	**9,152**	+110.1
725,000-750,000	*5,409*	**10,549**	+95.0

Atmospheric in *Italic*, Forced-draft in **Bold**

In 1979, the South Coast AQMD estimated the incremental cost for low-NOx atmospheric burners on new residential water heaters to be $10 per unit[5]. For these calculations, staff has more conservatively estimated the differential cost to be 10 percent of the cost of a standard unit. Since some research and development may be needed to adopt atmospheric low-NOx technologies, initial capital costs may be higher. However, with increased competition, costs should decrease to the 10 percent level over time. In this case, cost-effectiveness was determined using the average cost of a standard 150,000 BTU/hr unit.

In every other case, cost-effectiveness was calculated using the assumptions noted above and the capital cost for two specific pieces of equipment - the average costs in Table 6 were not used. Over a range of sizes, the cost-effectiveness for gas-fired equipment varies from $5,333 to $13,393 per ton of NOx reduced, with many results just under $10,000 per ton reduced. This is consistent with the District's cost-effectiveness guideline of $18,000 per ton of NOx reduced. The results appear in Table 5; the calculations appear in Appendix E.

Staff expects the cost of all gas-fired low-NOx equipment to decrease over time. Burner technology continues to develop and new manufacturers are expected to enter the market with novel substrate and burner designs. With both a SCAQMD and Ventura rule in place, manufacturers will build low-NOx units exclusively for the Southern California market. SCAQMD estimates the sale of 12,000 units annually; a market this size should result in both optimized manufacturing and lower costs.

Alternative Equipment

Also in Table 5 are the results of cost-effectiveness calculations for two electric water heater sizes. At a cost of around $200,000 per ton of NOx reduced, this technology is NOT cost effective. The expense that skews the results is the cost of electricity; the capital cost of electric units is not significantly different from that of low-NOx gas fired equipment. On this basis, electric water heaters cannot currently be considered a cost-effective alternative to gas-fired water heaters.

The cost-effectiveness of heat pump water heaters also appears to exceed District guidelines. Using a computer program obtained from a heat pump manufacturer, two water heater applications were

designed; one for an 80 unit apartment building and another for a 380 bed hospital. These cases correspond respectively to 95,000 BTU/hr and 400,000 BTU/hr gas-fired water heaters. In both cases, generous assumptions resulted in a cost-effectiveness of more than $150,000 per ton of NOx reduced; other assumptions only increased the cost. Unless better information is obtained, heat pump water heaters cannot be considered a cost-effective alternative to gas-fired water heaters.

In contrast, heat recovery water heaters appear to save money in every case. As noted above, these devices can be used either independently or in conjunction with other powered water heating equipment. These systems can be complicated, and staff has not attempted to design a complete heat recovery system. Nevertheless, staff has calculated the cost-effectiveness of substituting heat recovery water heaters for both atmospheric and forced-draft units in a variety of cases. In addition, a system using both a heat recovery unit and an atmospheric gas-fired water heater is also considered; in this case, the two systems work together to provide 350,000 BTU/hr of water heating capacity. In all cases, an annual cost savings was realized; see Table 5. According to the manufacturer, the addition of the heat exchanger to the heat supply system will reduce its operating pressure. This reduces electricity costs, further improving the annual cost savings[11].

SOCIOECONOMIC IMPACT

Assembly Bill 2061 (Polanco)[H&S § 40728.5], which went into effect on January 1, 1992, requires that the APCD Board consider the socioeconomic impact of any new rule or amendment to an existing rule if air quality or emission limits are affected. Proposed Rule 74.11.1 imposes emission limits and may affect air quality in Ventura County, so the requirements of the bill must be evaluated.

The Board must evaluate the following socio-economic information on new Rule 74.11.1:

(1) The type of industries or business, including small business, affected by the rule or regulation.

Rule 74.11.1 could affect any small or medium-sized business in Ventura County that requires a supply of hot water or steam. A list of source types currently using water heaters or small boilers in the applicable size range appears in Appendix A. It is not possible to predict any other type of new source to which Rule 74.11.1 will apply.

(2) The impact of the rule or regulation on employment and the economy of the region affected by the adoption of the rule or regulation.

The adoption of Rule 74.11.1 is expected to have no impact on employment in and the economy of Ventura County. The proposed rule is a point-of-sale rule, where new, low-NOx units replace obsolete standard units gradually over time. The cost-effectiveness of the proposed rule is favorable. While low-NOx units are typically more expensive than standard units, this additional expense is expected to have no effect on either employment in or the economy of the region.

(3) The range of probable costs, including costs to industry or business, including small business, of the rule or regulation.

Complying equipment may cost between 40 and 134 percent more than standard equipment; see Table 6. Over a range of sizes, the cost-effectiveness of gas-fired low-NOx water heaters varies from $5,333 to $13,393 per ton of NOx reduced, with many results just under $10,000 per ton reduced. This is consistent with the District's cost-effectiveness guideline of $18,000 per ton of NOx reduced. The results appear in Table 5; the calculations appear in Appendix E.

(4) The availability and cost-effectiveness of alternatives to the rule or regulation being proposed or amended.

As an alternative, the proposed NOx emission limits could be relaxed. However, as noted in the staff report, there are a number of manufacturers supplying equipment models that exceed the proposed emission requirements. Other manufacturers are expected to develop complying equipment as well, increasing competition and decreasing costs. The adoption of SCAQMD Rule 1146.2 has created a substantial market for these units. Although both electric and heat pump water heaters have been ruled out as cost-effective alternatives, heat

recovery water heaters reduce annual costs. However, heat recovery water heaters are applicable only in specific applications. Since complying equipment is available, staff feels that no alternatives to the proposed rule are necessary.

(5) The emission reduction potential of the rule or regulation.

The estimated total NOx emission reduction for proposed Rule 74.11.1 is estimated to be 0.09 tons per day, or 32.0 tons per year. This surpasses the emission reduction estimate of 0.06 tons per day in AQMP Control Measure N-102.

(6) The necessity of adopting, amending, or repealing the rule or regulation in order to attain state and federal ambient air standards pursuant to Chapter 10 (commencing with Section 40910).

By reducing NOx emissions, adoption of proposed Rule 74.11.1 will assist in the District's progress towards attainment and maintenance of the federal and California ambient air quality standards. The adoption of proposed Rule 74.11.1 is necessary to implement Control Measure N-102 from the 1997 *Air Quality Management Plan*.

ENVIRONMENTAL IMPACTS OF METHODS OF COMPLIANCE

California Public Resources Code Section 21159 requires the District to perform an analysis of the reasonably foreseeable environmental impacts of the methods of compliance. The analysis shall take into account a reasonable range of environmental, economic, and technical factors, population and geographic areas, and specific sites. The analysis must include the following information on the proposed rule:

(1) *An analysis of the reasonably foreseeable environmental impacts of the methods of compliance.*

The proposed rule is a point-of-sale rule, where new, low-NOx units replace obsolete standard units over time. Since units become obsolete at different rates and low-NOx units are expected to become obsolete at the same rate as standard units, no additional waste is expected to appear in landfills. In addition, old water heaters and small boilers are frequently recycled. The new low-NOx units are expected to cause no adverse environmental impacts. Since many forced-draft low-NOx designs have a greater thermal efficiency than atmospheric designs, a decrease in fuel consumption is expected for many new units.

(2) *An analysis of the reasonably foreseeable mitigation measures.*

Since no adverse environmental impacts are expected, no mitigation measures are proposed.

(3) *An analysis of the reasonably foreseeable alternative means of compliance with the rule or regulation.*

No alternatives are proposed. As shown in the staff report, there are a number of manufacturers supplying equipment that complies with the proposed rule. Other manufacturers are expected to develop complying equipment as well, increasing competition and decreasing costs. Although both electric and heat pump water heaters have been ruled out as cost-effective alternatives, heat recovery water heaters reduce annual costs. However, heat recovery water heaters are applicable only in specific applications.

The above analysis under Public Resource Code Section 21159 further demonstrates that there is no reasonable possibility that the adoption of proposed Rule 74.11.1 will have a significant effect on the environment due to unusual circumstances.

CEQA Requirements

Staff concludes that the adoption of proposed Rule 74.11.1 is within the scope of the categorical exemptions from the California Environmental Quality Act (CEQA) under state CEQA guideline Sections 15307, Protection of Natural Resources, and 15308, Protection of Environment, and that no exception to these categorical exemptions apply.

ANALYSIS OF EXISTING REGULATIONS

California Health & Safety Code Section 40727.2(a) requires districts to provide a written analysis of existing regulations prior to adopting, amending or repealing a regulation. Section 40727.2(a) states:

> In complying with Section 40727, the district shall prepare a written analysis as required by this section. In the analysis, the district shall identify all existing federal air pollution control requirements, including, but not limited to, emission control standards constituting best available control technology for new or modified equipment, that apply to the same equipment or source type as the rule or regulation proposed for adoption or modification by the district. The analysis shall also identify any of that district's existing or proposed rules and regulations that apply to the same equipment or source type, and all air pollution control requirements and guidelines that apply to the same equipment or source type and of which the district has been informed pursuant to subdivision (b).

Proposed Rule 74.11.1 applies to commercial water heaters and very small boilers rated from 75,000 BTU/hr to 2,000,000 BTU/hr input capacity. No known state or federal air pollution control regulations apply to this equipment.

The requirements in Subsection B.2.a of proposed Rule 74.11.1 are the same as the retrofit requirements in Subsection B.1 of District Rule 74.15.1 for equipment rated from 1,000,000 BTU/hr through 2,000,000 BTU/hr and with an annual heat rate of more than 1.8 billion BTUs. As such, new equipment within these ranges will be required to verify compliance at the intervals specified in Rule 74.15.1. Also, permit rules apply to units in this size range; see Appendix F for a list of applicable rules.

INCREMENTAL COST-EFFECTIVENESS

Health and Safety Code Section 40920.6 requires the performance of an incremental cost-effectiveness analysis for a regulation that identifies more than one control option to meet the same emission reduction objectives. Incremental cost-effectiveness is defined as the difference in costs divided by the difference in emission reductions between one level of control and the next more stringent level of control.

The proposed rule regulates the supply of applicable units in Ventura County; in doing so, it requires owners only to purchase a complying unit. For this rule, the next level of control would involve a retrofit requirement for existing units; such a requirement appears in SCAQMD Rule 1146.2. The incremental cost-effectiveness of these two cases appears below; the SCAQMD retrofit case[12] has been adjusted for Ventura County assumptions (no tune-up cost, CRF of 0.149, 12 percent capacity factor).

Table 7
Incremental Cost-Effectiveness
Retrofit VS New Only

System Type	Average Cost ($/yr)	Average Ton/yr	Cost Eff. ($/Ton)
SCAQMD Retrofit	444	0.036	12,333
New Units Only	251	0.025	10,040
Incremental	193	0.011	17,545

WORKSHOPS / COMMENTS

Comments are repeated verbatim (except as noted) and appear in italic. Staff responses follow.

Controlled Energy Corp.
January 12, 1999

[Does proposed Rule 74.11.1 apply] *only to natural gas fired units as SCAQMD Rule 1146.2 does?*

Proposed Rule 74.11.1 is <u>not</u> currently limited in applicability to natural-gas fired equipment. We may consider such a limitation if evidence warrants.

We believe our product will be exempt under definition #7. The Aquastar heats water in an "open loop" application and not in a "closed vessel device."

You are correct about our proposed definition of "water heater." We believe this definition will effect the status of any tankless water heater. We will check with the SCAQMD on the origin of the term "closed vessel." It seems that, under your definition, most tank-type water heaters are "open" rather than "closed." Nevertheless, it is not our intention to

exempt any applicable device. We [propose to remove] the words "closed vessel" from the definition of "water heater."

Gas Appliance Mfgr Assn
January 12, 1999

A. Applicability
The exception, "the rule shall not apply to units used in residential dwellings," is impractical and unworkable. Current federal minimum efficiency regulations for residential products define residential storage water heaters as models with inputs of 75,000 Btu/h or less, residential instantaneous water heaters as models with inputs of 200,000 Btu/h or less, and residential boilers as models with inputs of 300,000 Btu/h or less. All respective models meeting these federal definitions should be exempted from this rule. Insofar as the manufacturer is concerned, the company cannot base its compliance with this proposed rule on whether or not the unit is going to be installed in a residential dwelling. The manufacturer has no knowledge of, or control over, where any single unit of a given model will be installed. Also, this exception is meaningless in view of the certification requirements. Since certification is required on what is offered for sale, the process of establishing compliance will be completed well before any unit is installed. Thus, providing an exception based on where the unit is installed is worthless if compliance is required on what is offered for sale.

The residential exemption was included to relieve residential users of the requirements of the rule. However, you have a point. Since we expect that few, if any, residential situations (as defined in the rule) will require units in this size range, we will propose to delete the exemption for residential use (and rename the rule, as noted above).

B. Requirements
1. The requirements of paragraph B.1 are unsubstantiated. Notwithstanding, the existence of Rule 1146.2 in the South Coast Air Quality Management District (SCAQMD), there is no sound technical basis for this NOx limit of 40 nanograms per joule of heat output. The vast majority of commercial water heating equipment in this input range are commercial tank type water heaters. One of the issues being examined by the implementation study currently underway in the SCAQMD (as required by Rule 1146.2) is the appropriateness of the NOx limit for models within the input range of 75,000 Btu/h to 400,000 Btu/h. A report on that facet of the implementation study is required to be completed by June of this year. Any consideration of this requirement should be deferred until after that report has been issued and the SCAQMD Governing Board has reviewed it. Proposing this requirement at this time is premature since it is not all certain that the 40 nanograms per joule limit is technically feasible, economically appropriate or that complying models will be available.

According to our research, there are several companies making very low-NOx forced-draft units in this size range. While we are currently aware of only one low-NOx atmospheric unit on the market *[two as of 4/27/99]*, we expect that the low-NOx designs currently in use on "residential" units (up to 75,000 BTU/hr) will be used on "large" units to meet the 40 ng/j limit. We also expect these atmospheric low-NOx units to be less costly that the forced-draft units. Since the forced-draft units currently available are cost-effective, we plan to retain the proposed limits.

Furthermore, the average annual use of gas-fired pool heaters, typically units with inputs of 400,000 Btu/h or less, is 104 hours of burner on-time. This information was developed by the U.S. Department of Energy based on a number of studies, most of them conducted in California. Accordingly, because of such a low usage, all pool heaters in this input range should be exempted.

As noted in our staff report (sent separately), our intention in developing the proposed rule is to capitalize on the market for low-NOx water heaters created by South Coast AQMD Rule 1146.2. To do this, we intend to keep the requirements as similar as possible. SCAQMD Rule 1146.2 Section (h)(2) exempts low-use units only from the retrofit requirements in Sections (c)(3), (c)(4) and (c)(5). Proposed Rule 74.11.1 includes no retrofit requirements. Therefore, no pool heater exemption is proposed.

Consistent with deferring consideration of this requirement, the proposed December 31, 2000, effective date should be suspended until all other issues have been addressed and resolved.

We are committed to compliance dates currently proposed in Rule 74.11.1. If the SCAQMD makes changes to Rule 1146.2, we will address those changes as necessary.

2. The effective date for the requirements of paragraph B.2 should be extended to June 1, 2000. Even though units complying with this requirement will be available in the SCAQMD by January 1, 2000, the effective date for this rule should allow adequate time between the actual adoption of the rule and its effective date for contractors and sellers of equipment covered by the rule to clear out their inventory.

According to several local suppliers, no more than five units in this size range are kept in inventory. Of those, all are under 300,000 BTU/hr in size. In addition, turnover rates of one to three per month indicate that inventory will not be a problem. Our current rule adoption schedule should provide a 3 to 6 month cushion between adoption of the rule and its effective date for units 400,000 BTU/hr or more. Therefore, no delay in implementation is proposed.

C. Certification

Since the provisions of this rule apply to any person selling, offering for sale, or installing units covered by this rule in Ventura County the requirements of paragraph C for certification should also be their responsibility. The seller or installer, not the manufacturer, should be required to provide certification to the Air Pollution Control Officer.

We do not believe that it is reasonable for local suppliers and installers to perform certification tests. Since units are test by model, randomly selected, according to the SCAQMD protocol, it would be impossible for a supplier or installer to meet the test requirements for a reasonable cost. Although still costly for the manufacturers, each certification test will apply to a three year production run for that model. It follows that certification paperwork should be handled by the manufacturer.

Also, the rule should specifically recognize compliance of a model with SCAQMD Rule 1146.2 and accept evidence of such compliance without any other additional paperwork requirements.

As stated in the staff report, we intend to accept SCAQMD certifications with no further testing. However, we intend to retain certification authority in case it is needed in the future. We also intend to gather certification information on complying equipment, as specified in Section C. We do not intend to specifically reference SCAQMD Rule 1146.2 in our rule.

D. Identification of Complying Water Heaters

The requirement of paragraph D that the certification status of the model be displayed on the shipping carton should be deleted. The model number adequately identifies complying models and many models covered by this proposed rule are not shipped in shipping cartons because of their size and shape.

Since certifications will be done by the manufacturers, evidence of certification must appear on each individual unit. Identification only by model number will make enforcement of the rule very difficult. However, we agree that "shipping cartons" may not always be used. We propose to delete "shipping carton" and add the following to Section D:

> <u>If the permanent nameplate is obscured by packaging, the model number and certification status shall also appear on the packaging.</u>

F. Definitions

[The] *definition of "Heat output" in paragraph F.2 should be revised to use "thermal efficiency" rather than "recovery efficiency." The recovery efficiency does not apply to models covered by this proposed rule. The applicable efficiency measure for such equipment is the thermal efficiency.*

We agree that our definition of "Heat output" is insufficient; it appeared originally in District Rule 74.11, Residential Water Heaters. We propose a definition similar to the one in SCAQMD Rule 1121; this definition refers to the certification test protocol for specific heat output calculation procedures.

> <u>F.2. "Heat output": The product H_O as defined in Section 9.3 of the South Coast Air Quality Management District *Protocol* cited in Attachment A.</u>

We will not be able to attend the workshop on January 14, 1999. Since the STAFF REPORT will not be available until the workshop and since the SCAQMD NOx requirement for models with inputs of 400,000 Btu/h or less is in fact still under study, we request that a second workshop be held to allow for a complete discussion of the draft report and the outcome of the SCAQMD implementation study.

We do not believe that another workshop is necessary at this time. We intend to present the rule to the APCD Advisory Committee on March 23, 1999 [rescheduled to April 27, 1999]; additional public input will be accepted at that meeting.

Parker Boiler Company
January 13, 1999

*1. **Units above 1 million BTU.** At this time, large units require a permit from Ventura APCD. Will this rule nullify the permit threshold for gas fired boilers such that units between 1 and 2 million BTU's do not need a permit to operate? It appears that this rule would double regulate boilers from 1 to 2 million BTU's, please clarify.*

Proposed Rule 74.11.1 will apply to any person "selling, offering for sale, or installing" any applicable unit. Regarding units in the 1 to 2 million BTU/hr size range, the requirement for permits will continue. In addition, the requirement in Rule 74.15.1 for annual source testing on units in this size range that utilize more than 1.8 billion BTUs of fuel per year will also continue. In fact, under Rule 26, New Source Review, new units between 1 and 2 million BTU/hr may be required to meet a NOx limit lower than 30 ppm. Proposed Rule 74.11.1 will effect only the supply of units; after December 31, 1999, all units [of this size] sold in Ventura County will meet or exceed both the 30 ppm NOx and 400 ppm CO emission limits.

*2. **Certification.** Approved certification section C indicates that a separate source test would be required for each unit sold in the Ventura APCD. The South Coast Air Quality Management District has a similar certification program and protocol developed. The cost of testing each unit is approximately $4,000.00 to $5,000.00 for boilers regulated by this category. It would seem reasonable and logical to adopt a family of units approach such that families of units could be evaluated. The South Coast Air Quality Management District has a similar procedure and is implementing that. Additionally due to the high cost and low number of units sold in Ventura APCD, we feel it would be prudent to accept SCAQMD certification, as the rules and regulations are the same. Perhaps you could evaluate the reports submitted to SCAQMD.*

We intend to accept SCAQMD certifications.

*3. **Enforcement.** Item E-2 states that Field Emission tests should be conducted on units fired at maximum capacity. Please clarify the requirement for this whether it will be a spot check or a regular requirement.*

Because all units sold will be pre-certified, we believe that few field emission tests will be required. However, a test method and firing guideline is being included to satisfy EPA and ARB requirements. If a field test is required, operational parameters, such as firing rate, should be established in a source test protocol prior to testing.

4. Please clarify if presently permitted units between 1 and 2 million BTU's will be taken out of the permit system and a Source Test will not be required on a regular basis on these units.

See response to Comment 1 above.

Workshop
January 14, 1999

All relevant comments from the workshop are paraphrased and appear in italic; staff responses follow. Some of the staff responses have been expanded.

For units from 1,000,000 BTU/hr through 2,000,000 BTU/hr, Rule 74.15.1 includes an "exemption" for low-use units. Proposed Rule 74.11.1 has no low use threshold; is this a problem?

Proposed Rule 74.11.1 applies only to new or replacement units sold in Ventura County; as such, only the supply of units available is effected. Rule 26, New Source Review, also applies to units in this size range, with no low-use threshold. It is possible that, under NSR, BACT will be much more stringent than the proposed 30 ppm NOx limit. The proposed rule will insure that all new units installed in the county will meet, at a minimum, the proposed 30 ppm NOx limit. The low-use threshold in Rule 74.15.1 will primarily effect the need for either source tests or tune-ups for the above units.

The rule states that installers and suppliers will be inspected. Will manufacturers be inspected also? How will installers get certification information?

We do not plan to inspect manufacturers. Compliance information should appear on both the packaging and the nameplate.

What information should appear on the nameplate? Should both the SCAQMD rule and the VCAPCD rule be listed?

Since we intend to accept SCAQMD certifications, it makes sense to accept units labeled for compliance with the SCAQMD rule. Certification data will still need to be submitted to the District according to Section C of the proposed rule. A certification label for Ventura County should read: "This unit complies with the provisions of VCAPCD Rule 74.11.1."

My company holds no inventory; we build each unit to order from established UL approved designs. How can these units be certified?

We see no problem certifying units built from a fixed model design. Although units cannot be selected "randomly" for certification, as stated in Subsection C.1, units built from a fixed design should be substantially the same. However, we will defer to any SCAQMD decision on the certification of these units.

Will this rule apply to units installed before the compliance dates?

The rule applies to new and replacement units sold or installed after the compliance dates. No existing unit will be impacted; in other words, existing units will not be required to retrofit low-NOx burners.

Why has the District chosen to omit the retrofit requirement?

AQMP NOx Control Measure N-102 does not require retrofits.

Does this rule apply to just natural gas-fired units?

No, the rule is not limited to just natural gas units. Is this an issue for the manufacturers?

It depends on how many units currently use alternate fuels - if that number is insignificant, then it should be no problem. The production of LP and propane units at our company is small; 10% or less.

Our impression is that few alternative-fuel units are used in California. Most of these units are used in the midwest or east coast. However, by not limiting to natural gas, the availability of complying alternative-fuel units may be limited.

According to Subsection E.2, emission tests are to be done at maximum rated capacity, or as near as practicable. ANSI standards have a 2 percent tolerance for rated capacity. What are the District's guidelines?

The statement in Subsection E.2 is included as a frame of reference. For an actual field test, "maximum capacity" should be established by agreement between the source operator and the District and stated in the source test protocol. The firing rate is somewhat flexible because source tests typically run for at least an hour; operation at absolute maximum capacity for an hour could damage some units.

Did you verify the low-NOx emission claims in Table 2? Will you test these claims?

Those emission estimates came from the manufacturers, via either a publication or a telephone call. No District testing was done to verify the claims and none is planned. We expect all claims to be verified during the certification process.

Do you plan to do any periodic testing, perhaps with a portable analyzer?

Only units from 1,000,000 BTU/hr through 2,000,000 BTU/hr that surpass the annual fuel-use threshold in Rule 74.15.1 of 1.8 billion BTUs will be tested annually. Units with an annual fuel use of less than that amount will be required to do tune-ups.

What type of source testing is required in Rule 74.15.1? Is a NOx test included? If the unit is not in compliance, what happens?

Typical ARB Method 100 source tests are required, paid for by the operator. NOx testing is included. A non-complying unit will need to be fixed and retested. In Rule 74.15.1, the operator is responsible for any repairs. Manufacturers may or may not get involved, depending on the relationship between the operator and the manufacturer.

I suggest relocating the 3 percent oxygen reference from Subsection E.2 to Subsections B.1.a and B.2.a.

In all other District NOx control rules, the percent oxygen reference point is included in the "Test Methods" section. Since we anticipate few field source tests, the proposed rule includes only an "Enforcement" section. However, to maintain some consistency with other District rules and to avoid unnecessary repetition, we intend to leave the percent oxygen reference in Subsection E.2.

Sempra Energy
February 1, 1999

Applicability: Two different prohibitory rules (74.11.1 and 74.15.1) apply to the same equipment ranges (1 - 2 MMBTU/h). This adds unnecessary confusion and complications. We appreciate the logic behind mirroring SCAQMD Rule 1146.2, and recognize the two rules are not currently contradictory. Multiple rules applying to the same equipment range may cause confusion for consumers and operators. In order to alleviate any confusion and clarify the intent, Rule 74.15.1 should be modified to include the following language.

"certified units complying with the emissions requirements of Rule 74.11.1 shall be deemed compliant with the emissions requirements of 74.15.1 & shall not require periodic testing".

We believe Rules 74.15.1 and proposed Rule 74.11.1 are compatible. The proposed rule applies to any person "selling, offering for sale, or installing" a unit in the 1 to 2 million BTU/hr size range. In this size range, both the requirement for permits and the requirement in Rule 74.15.1 for annual source testing on units utilizing more than 1.8 billion BTUs of fuel per year will be retained. In fact, under Rule 26, New Source Review, new units in this size range may be required to meet a NOx limit lower than 30 ppm. Proposed Rule 74.11.1 will effect only the supply of units; after December 31, 1999, all units sold in Ventura County will meet or exceed both the 30 ppm NOx and 400 ppm CO emission limits.

Equipment Availability:
The District staff assumption that equipment meeting the rule emission limits requirements will be available by the compliance deadlines is overly optimistic. The market is not expected to keep up with the regulations and offers no recourse for the consumer should suitable equipment not be available. The District offers a table indicating equipment meeting the proposed emission limits is available in all size ranges. The District does not seem to understand the difference between input requirements and operational requirements. End uses, frequency of demand, and available space vary widely between different facilities. A water heater perfectly appropriate for one facility may be completely inappropriate for another facility, even though the two water heaters have identical inputs. District staff acknowledges that at least two of three identified alternatives are not cost effective. The rule language must recognize the possibility that equipment might not be available by the compliance date and hold off implementation of 74.11.1 should that be the case.

We disagree with your assumption that equipment will not be available. With at least 13 companies already manufacturing complying equipment, and several others known to be developing complying equipment, we believe that a wide variety of units for any application will be available on the proposed dates.

Cost Effectiveness:
The District makes a number of assumptions when calculating cost effectiveness of this rule. Some of these assumptions do not accurately reflect the costs or emission reductions inherent in this rule.

- *Fuel Cost: For fuel cost calculations, staff incorrectly uses a cost per therm estimate from a residential gas bill (Staff Report, p9). Actual commercial rates typically range from $0.40 to $0.70/therm, depending on monthly usage, and the number the District used ($0.521/therm) is within this range. The Gas Company's commercial rates are readily available via telephone or Internet. We recommend $0.50/therm as a good estimate of commercial rates.*

Comment noted.

- *Fuel Savings for Forced-Draft: District assumes a 10% fuel-usage savings by switching from atmospheric to forced-draft burners, which the staff report alleges have "higher thermal efficiencies." Staff does not cite a reference for this information; this reference must be included for review. Improvements in burner efficiency do not necessarily result in improvements in boiler efficiency. Improvements may occur, but are not consistent and therefore cannot be relied upon in cost-effectiveness calculations. In some cases, there may be as much as a 5 to 10% fuel penalty for using a low NOx burner. However, we feel a value of 0% efficiency change best reflects the uncertainty surrounding this issue.*

We disagree with this statement. We have gathered information from many equipment manufacturers, and this data indicates that the best atmospheric units available have an average thermal efficiency of 80 percent, peaking at 82 percent. The average efficiency for forced-draft low-NOx units is 87 percent, peaking at 94 percent. However, we believe that a majority of the units sold in Ventura County will replace standard units operating at an efficiency considerably less than 80 percent. Therefore, we stand by our estimated 10 percent fuel efficiency savings.

- *Uncontrolled Emission Rate: The District uses an uncontrolled emission rate of 0137 lb NOx/MMBTU (0.17 for 400.000 BTU/hr forced-draft burners), again without citing a reference. Gas Company service technicians often check NOx levels when performing flue gas analyses for customers. In a review of 95 tests, we found an average NOx emission rate*

Table 8
Sempra Energy Cost-Effectiveness Calculations

	135,000 BTU/h		*150,000 BTU/h*		*300,000 BTU/h*		*400,000 BTU/hr*	
	VCAPCD	*SoCalGas*	*VCAPCD*	*SoCalGas*	*VCAPCD*	*SoCalGas*	*VCAPCD*	*SoCalGas*
Fuel Savings (96)	*10*	*0*	*0*	*0*	*10*	*0*	*0*	*0*
Annual Fuel Cost Savings ($/yr)	*74*	*0*	*0*	*0*	*164*	*0*	*0*	*0*
Annual Cost Differential ($/yr)	*129*	*129*	*32*	*32*	*318*	*318*	*375*	*375*
Emission Rate Reduction (lb/MMBTU)	*0.125*	*0.107*	*0.072*	*0.054*	*0.125*	*0.107*	*0.135*	*0.084*
Electricity Costs for fan	*34*	*34*	*N/A*	*N/A*	*34*	*34*	*N/A*	*N/A*
Emission Reduction (Tons/yr)	*0.009*	*0.008*	*0.006*	*0.004*	*0.020*	*0.017*	*0.028*	*0.018*
Annual Cost ($/yr)	*89*	*163*	*32*	*32*	*188*	*352*	*375*	*375*
Cost Effectiveness ($/ton)	*10034.39*	*21469.14*	*5637.30*	*7516.40*	*9538.31*	*20863.27*	*13212.41*	*21234.24*

of 0.119 lb NOx/MMBtu. We recommend use of this value for an average uncontrolled emission rate, since it is based on actual field measurements.

Both emission rates are referenced in the second paragraph on page 8 of the staff report. Without better documentation on your test program, we are reluctant to use the data.

A comparison between <u>The Gas Company's</u> calculations and those of the District is useful. Only switching from forced-draft to low-NOx forced-draft units will meet the District's cost-effectiveness criteria. [See Table 8]

We disagree with your assumptions on both fuel savings and uncontrolled emission rates. We believe our assumptions for these variables are appropriate and based on sound data; therefore, we believe our cost-effectiveness calculations are valid.

Comparison to South Coast AQMD's Rule 1146.2: Rule 74.11.1 exactly mirrors SCAQMD's Rule 1146.2 and the District stated reasons for this are legitimate. Rule 1146.2 [is] *very controversial and remains so. Questions about Rule 1146.2's applicability, cost effectiveness, estimated fuel savings, and ability to achieve actual emission reductions are still being discussed. Rule 1146.2 requires a study to resolve these issues. That study is currently underway, and it will be presented to SCAQMD within a year. The prudent choice for Ventura would be to hold off on passage of 74.11.1 until the SCAQMD study has been completed and all questions resolved. It does not make sense to compound the problems present in 1146.2 when they could so easily be avoided. The prudent choice is to take advantage of a study that is already underway and will provide a sound basis for rule formation.*

At this time, we are committed to compliance dates currently proposed in Rule 74.11.1. If the SCAQMD makes changes to Rule 1146.2, we will address those changes as necessary.

Sempra Energy
April 7, 1999

We reiterate our concern about the commercial availability of compliant equipment.

The Gas Company *conducted an analysis of the equipment currently available meeting the proposed emissions limits of Rule 74.11.1. For tank-type water heaters, the choices in the smaller range (<100 MBtu/hr.) are limited. For water heaters less than 90 MBtu/hr., only A.O. Smith now manufactures a tank-type water heater that will meet the limits. Heat Transfer Products manufactures the only other water heaters available rated at less than 100 MBtu/hr. Tank type water heaters are the most frequently used types by smaller customers, (e.g., restaurants). When a tank type water heater is being used, it is generally extremely difficult to substitute another type of equipment in these applications because of space constraints. Although the manufacturers expect to have several more units available by the rule deadline, the market may not keep up with the regulations. If this occurs, consumers will be forced to purchase the only equipment available and this equipment may not be cost-effective. This has the potential of creating an undue burden for the small businesses that use this equipment.*

We recommend the rule language must recognize that cost-effective equipment may not be available by the compliance date and hold off implementation of 74.11.1 should that be the case.

Assuming that 10 percent of existing units between 75,000 and 100,000 BTU/hr in both the South Coast basin and Ventura County are replaced every year, and adding 10 percent of that for new construction, about 2700 units will be needed annually. In Ventura County, 90 units will be needed. In addition to equipment manufactured by A. O. Smith and Heat Transfer Products, four other companies are producing complying equipment in this size range now (RBI, Glow Core, Lochinvar, and Monitor Products). While not all of these units are tank-type, we believe that the use of alternate designs may be appropriate for many local applications. In addition, at least two other companies are expected to have complying tank-type equipment in this size range available before the January 1, 2001, compliance date.

We believe that these eight companies can provide the necessary inventory to supply demand. If changes to the compliance schedule in SCAQMD Rule 1146.2 occur, we will take whatever steps are necessary to accommodate the change in Ventura County.

Gas Appliance Mfgr Assn
April 26, 1999

[W]*e reaffirm that the 40 ng/joule of heat output NOx limit for units in the input range of 75,000 BTU/h to 400,000 BTU/h has not been justified.*

We believe that the limit is justified by the past performance of residential atmospheric water heaters. So far, two manufacturers are marketing atmospheric heaters in the smaller sizes that meet the proposed limit. In addition, many companies offer forced-draft equipment in the larger sizes that either meet or exceed the proposed limit.

It is incorrect to associate any fuel savings as benefit of low NOx water heating equipment. All gas fired pool heaters and commercial gas fired water heaters manufactured for sale in the U.S. today are required by federal regulation to have a minimum thermal efficiency of 78%. For many existing installations, a new water heater or pool heater will provide fuel savings. But, this is totally independent of the NOx emissions of the equipment.

We associate fuel savings with the use of forced-draft equipment over atmospheric equipment. This is because most currently available complying equipment is forced-draft. No fuel savings is assumed when an atmospheric unit replaces an atmospheric unit.

The cost of the low NOx equipment is under-estimated. The 10% estimated increase is too low.

This is the estimated increase in cost for a low-NOx atmospheric unit over a "standard" atmospheric unit. Forced-draft unit costs are significantly higher than atmospheric unit costs, as stated in the staff report. While research and development may drive up costs initially, we believe that the final cost for an atmospheric low-NOx unit will settle out at about 10 percent more than an uncontrolled unit. A low-NOx atmospheric water heater currently offered by one manufacturer is no more costly than a comparable "standard" unit from the same company.

The capital recovery factor is wrong for commercial water heaters. This factor is based on a 10-year life. The typical life of these products is 5 years.

While manufacturer's guarantees generally do not exceed 5 years, we have heard from manufacturers that the actual operating life of the equipment is expected to exceed 10 years.

The controlled emission rate of 55 ppmv is too low. The 40 ng/joule emission rate for equipment operating at efficiencies around 78% is about 65 to 70 ppm. The 55 ppm equivalent number is based on a 70% efficiency which does not apply to current models.

Our calculations for converting ng/j to ppmv are similar to yours. However, to insure maximum market compatibility, we are reluctant to change a limit included in SCAQMD Rule 1146.2. If the SCAQMD revises this limit, we will consider adjusting ours as well.

The switch from an atmospheric model to a forced draft model may require changes to the venting system. These costs are not factored in at all.

We acknowledge that vent system costs are not included in the cost effectiveness estimates. However, vent arrangements vary widely and are difficult to predict. Additionally, we expect vent system costs to be minimal. We have been unable to get installation cost estimates from anyone and, therefore, have assumed that all installation costs are similar. We are willing to look at vent cost information within the context of specific installation cost estimates.

Also, many of the units that are identified as low NOx models that are currently available, are not commercial tank type models. That is the type of water heating equipment that is predominant in the 75,000 to 400,000 BTU/h input range. It is unrealistic to assume that the "available" units can just be dropped in as a replacement for an existing commercial water heater. Also, many of these units are available in only one or two inputs and none of the NOx emissions are certified values based on the SCAQMD protocol.

There is no reason to believe that all units in the 75,000 to 400,000 BTU/hr range must be "tank-type" models. We believe that at least one of the vast number of complying units available either now or in the future will be adequate for any application. We do not expect any of these units to have certification problems.

We also note that no cost effectiveness analysis has been done specifically for gas fired pool heater with inputs of 400,000 BTU/h or less. These products have a distinct usage and the cost of low NOx models of pool heaters is a separate factor. As an example the 104 hours of annual usage determined by the U.S. Department of Energy equates to a capacity factor of .01. This is l0 times lower than the capacity factor used in the draft report for commercial water heaters.

As stated in our previous letter, we intend to keep the requirements of Rule 74.11.1 as similar as possible to those in South Coast AQMD Rule 1146.2, which exempts low-use units from retrofit requirements only. Proposed Rule 74.11.1 includes no retrofit requirements. In addition, while pool heaters in residential situations may indeed have low capacity factors, other uses (such as apartment complexes) may have significantly higher capacity factors. Therefore, no pool heater exemption is proposed.

We do not understand why using only the model number to identify complying units will make enforcement difficult. Since the manufacturer's compliance report will provide the model number, it will be simple to create a list of complying models by model number. Furthermore, since the rule applies to any person selling, offering for sale or installing units covered by the rule in Ventura County, the list can be provided to those sellers and installers with the notice that those are the only models they can sell. Every unit bears a model number. A list of complying models should be completely adequate for enforcement purposes.

We disagree with your position. We believe that, since manufacturers are responsible for certification, manufacturers should be responsible for identifying complying equipment.

It has been readily acknowledged that it is the intent to keep the requirements of proposed Rule 74.11.1 as close as possible to the SCAQMD Rule 1146.2. However, you should be aware that there is an implementation study on Rule ll46.2 being done. One of the issues being addressed by that study is the NOx limit for units in the input range of 75,000 BTU/h to 400,000 BTU/h. The report from that study should be available by late June, l999. We suggest that further action on proposed Rule 74.11.1 be delayed until after that report has been reviewed and considered by the SCAQMD Governing Board.

We are aware of the SCAQMD Rule 1146.2 working group and will monitor developments. Currently, our Air Pollution Control Board is schedule to consider proposed Rule 74.11.1 on July 13, 1999. If changes to SCAQMD Rule 1146.2 are proposed, we will take whatever steps are necessary to accommodate the change in Ventura County.

Advisory Committee
April 27, 1999

Little discussion of the proposed rule occurred at the meeting. Representatives from three equipment manufacturers appeared to support the proposed rule. The Advisory Committee unanimously recommended proposed Rule 74.11.1, as well as the recommended removal of 1997 AQMP further study control measure N-112.

REFERENCES

1. Correspondence from Reese Martin, Southern California Gas Company, October, 1997

2. Correspondence from Reese Martin, Southern California Gas Company, December 30, 1996

3. Correspondence from Robson Longwell, Southern California Gas Company, September 3, 1985

4. Pease, Robert and Pourzand, Henry, *Final Staff Report for: Proposed Rule 1146.2 - Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers*, South Coast Air Quality Management District, Stationary Source Compliance, December 12, 1997, Page 2

5. ibid., Page 4

6. ibid., Page 3

7. ibid., Page 5

8. ibid., Page 8

9. *E-Tech WH Series Heat Pump Water Heaters* specification brochure, Crispaire Corporation, Norcross, GA, May, 1996

10. Telephone conversation with Rebecca Oulton, Southern California Gas Company, January 5, 1999

11. Telephone conversation with John Lebo, Doucette Industries, York, PA, February 12, 1999

12. Pease, Robert and Pourzand, Henry, *Final Staff Report for: Proposed Rule 1146.2 - Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers*, South Coast Air Quality Management District, Stationary Source Compliance, December 12, 1997, Page APP A.5

Appendix A
Business Types using Large Water Heaters
In Ventura County, By SIC Code[1]

SIC	Business Type	Count
8211	Elementary & Secondary Schools	71
7216	Dry Cleaning Plants, Except Rug Cleaning	64
7215	Coin-Operated Laundries & Dry Cleaning	53
7011	Hotels & Motels	38
5812	Eating Places	17
6512	Operators of Nonresidential Buildings	16
8222	Junior Colleges and Technical Institutes	15
8661	Religious Organizations	14
	Unlisted	12
8011	Offices & Clinics of Doctors of Medicine	11
7997	Membership Sports and Recreation Clubs	11
8221	Colleges, Universities & Pro. Schools	10
8059	Nursing and Personal Care Facilities, NEC	9
3761	Guided Missiles & Space Vehicles, Mfgr	7
7299	Miscellaneous Personal Services, NEC	6
9223	Correctional Institutions	5
7999	Amusement & Recreation Services, NEC	5
6531	Real Estate Agents and Managers	5
3674	Semiconductors & Related Devices, Mfgr	5
9711	National Security	4
8062	General Medical And Surgical Hospitals	4
7542	Car Washes	4
5199	Nondurable Goods, NEC, Wholesale Trade	4
0181	Ornamental Floriculture & Nursery Prod.	4
8721	Accounting, Auditing & Bookkeeping	3
7538	General Automotive Repair Shops	3
7021	Rooming & Boarding Houses	3
6513	Operators of Apartment Buildings	3
5511	Motor Vehicle Dealers (New & Used)	3
3589	Service Industry Machinery, NEC, Mfgr	3
3325	Steel Foundries, NEC	3
2033	Canned Fruit, Vegetables, Preserves, Jams	3
3662	Radio & Television Broadcasting Equip	2
9211	Courts, Government	2
1611	Highway & Street Construction	2
9111	Executive Offices, Government	2
8361	Residential Care	2
8322	Individual & Family Social Services	2
8231	Libraries	2
8063	Psychiatric Hospitals	2
7991	Physical Fitness Facilities	2
7372	Prepackaged Software, Service	2
0182	Food Crops Grown Under Cover	2
6036	Savings Institutions, Not Fed. Chartered	2
4841	Cable & Other Pay Television Services	2
1382	Oil & Gas Exploration Services	2
1521	Gen. Contractor - Single Family Houses	2
7212	Garment Pressing, & Agents for Laundries	2
0723	Crop Preparation Services for Market	2
1389	Oil & Gas Field Services, NEC	2
5137	Women, Children, Infant Clothing Whsle	2
5191	Farm Supplies, Wholesale Trade	2
5311	Department Stores, Retail	2
5461	Retail Bakeries	2
6022	State Commercial Banks	2
9532	Admin. of Urban Planning / Com. Develop.	1
9511	Air & Water / Solid Waste Management	1
8731	Commercial Physical & Bio. Research	1
8641	Civic, Social & Fraternal Organizations	1
8611	Business Associations	1
8412	Museums and Art Galleries	1
8399	Social Services, NEC	1
0721	Crop Planting, Cultivating & Protecting	1
7819	Services / Motion Picture Production	1
5083	Farm & Garden Machinery & Equip Whsle	1
7941	Professional Sports Clubs and Promoters	1
5012	Furniture & Home Furnishings, Wholesale	1
7694	Armature Rewinding Shops	1
4941	Water Supply Systems	1
6552	Land Subdividers and Developers	1
4813	Telephone Communication	1
6162	Mortgage Bankers and Loan Agents	1
4493	Marinas (Boat Yards)	1
6021	National Commercial Banks	1
4311	U.S. Postal Service	1
5992	Florists, Retail	1
4226	Special Warehousing & Storage, NEC	1
5611	Men's & Boys Clothing Stores, Retail	1
4173	Terminal & Service for MV Pass. Trans	1
5261	Nurseries, Lawn & Garden Supply, Retail	1
3843	Dental Equipment & Supplies, Mfgr	1
8351	Child Day Care Services	1
3821	Laboratory Apparatus & Furniture, Mfgr	1
6331	Fire, Marine and Casualty Insurance	1
3728	Aircraft Parts & Aux. Equipment, Mfgr	1
6011	Federal Reserve Banks	1
3599	Industrial & Commercial Machinery, Mfgr	1
5411	Grocery Stores, Retail	1
7213	Linen Supply	1
6061	Credit Unions, Federally Chartered	1
5963	Direct Selling Establishments, Retail	1
5231	Paint, Glass & Wallpapers Stores, Retail	1
3471	Electroplating, Plating, Polishing...	1
3362	Brass, Bronze, Copper Foundries	1
3361	Aluminum Foundries (Castings)	1
3272	Concrete Products - Mfgr	1
2834	Pharmaceutical Preparations - Mfgr	1

Appendix B
Water Heater Use Information from Southern California Gas Company 12/30/96[2]

Boiler And Water Heater Rating	Number of Boilers and Water Heaters	Percentage of Total	Total Throughput	Average Unit Throughput
BTU/hr			MBTU/year	MBTU/year
Less Than 75,000	2,428	54.2	81,783,533	33,583
75,000 to 100,000	821	18.3	113,166,530	137,840
100,001 to 200,000	242	5.4	33,875,061	139,980
200,001 to 300,000	181	4.0	55,349,838	305,800
300,001 to 400,000	178	4.0	81,487,899	457,797
400,001 to 500,000	87	1.9	40,213,782	462,227
500,001 to 600,000	48	1.1	37,214,913	775,311
600,001 to 700,000	71	1.8	50,752,016	714,817
700,001 to 800,000	74	1.7	54,410,344	735,275
800,001 to 900,000	42	0.9	27,964,740	665,827
900,001 to 1 MM	75	1.7	115,709,009	1,542,787
Greater Than 1 MM	236	5.3	1,201,324,169	5,090,357
TOTAL	4,483	100.0	1,893,251,734	----------

Appendix C
Boilers Permitted in Ventura County, One - Two Million BTU/hr Subject to 30 NOx Limit in Rule 74.15.1 (Subsection B.1)

File	SIC	Company	Mfgr.	Model Number	Size	Burner	Type
1381	2834	Amgen	Bryan	CL150W100CU-	1.500		B
1381	2834	Amgen	Bryan	CL150W100CU-	1.500		B
1381	2834	Amgen	Patterson Kelly	N1700	1.700		B
1381	2834	Amgen	Patterson Kelly	N1700	1.700		B
0805	3728	Composit Air	Parker	48	1.995	LoNOx	B
0977	1311	GEO Petroleum	Petrotherm		2.000		B
7052	4813	GTE	Ajax	WEG-2000	1.800		B
0408	8211	Glenwood Elem. School	Ajax	WG1500	1.200		B
0411	8211	Los Cerritos Int. School	Ajax	WGB2000	1.600	LoNOx	B
7109	8211	Meadow Elementary	Raypak	H1468A	1.470		B
7061	8211	Oxnard Union High School	Bryan	CL150	1.500		B
7061	8211	Oxnard Union High School	Bryan	CL150	1.500		B
0679	723	Paramount Citrus	Cook		1.750		H
0413	8211	Redwood Int. School	Ajax	WG1375D	1.100	LoNOx	B
1291	3674	Rockwell Int'l - WCD	Weil McLain	788	1.600	LoNOx	B
0138	8062	Santa Paula Mem. Hospital	Parker	G40HPIC-LN	1.680	LoNOx	B
0138	8062	Santa Paula Mem. Hospital	Parker	G40HPIC-LN	1.680	LoNOx	B
0414	8211	Sequoia Int. School	Raytherm		1.238		B
0133	8211	Thousand Oaks High School	York Shipley	SPWV50N	1.800		B
0133	8211	Thousand Oaks High School	Ajax	WGFD2250	1.995		B
0133	8211	Thousand Oaks High School	Raypak	E1330TA	1.400		B
0133	8211	Thousand Oaks High School	Raypak	P1825A-BCD2D	1.826		B
0999	9711	US Navy - NAWS	Lochinvar	CFN1800PM	1.800		B
0999	9711	US Navy - NAWS	Rite	180WG	1.500	LoNOx	B
0999	9711	US Navy - NAWS	Burnham	4FW-209-45-G	1.941		B
0999	9711	US Navy - NAWS	Rite	180WG	1.500	LoNOx	B
0999	9711	US Navy - NAWS	Lochinvar	CFN1800PM	1.800		B
1003	9711	US Navy - NFESC Bldg #560	Lattner		1.150		B
0415	8211	University Elem. School	Ajax	WG1375	1.375		B
0432	8211	Ventura High School	Ajax	SGX2000D	1.600		B
0432	8211	Ventura High School	Ajax	2000	1.600		B
0432	8211	Ventura High School	Ajax	SGX1750	1.500	LoNOx	B
0540	9531	Ventura Housing Authority	Parker	T2160	1.900	LoNOx	B
1377	9111	Ventura WWTP	Rite	200	1.875		B
1377	9111	Ventura WWTP	Rite	200	1.875		B
0416	8211	Weathersfield Elem. Schol	Ajax	WG1375	1.100	LoNOx	B
0417	8211	Westlake High School	Bryan	CL150	1.200		B
0417	8211	Westlake High School	Ajax	WGX2000	1.600		B

Legend:
SIC - Standard Industrial Classification Code
Type - B = Boiler, H = Heater Treater, P = Process Heater

Appendix D
Boilers Permitted in Ventura County, One - Two Million BTU/hr Subject to Tune-Up Requirement in Rule 74.15.1 (Subsection B.2)

File	SIC	Company	Mfgr.	Model Number	Size	Burner	Type
0426	8211	Anacapa Middle School	Ajax	SGX2000D	2.000		B
7271	1799	Ancon Marine	Sande	3510	1.500	Diesel	B
7271	1799	Ancon Marine	Sande	3510	1.500	Diesel	B
7271	1799	Ancon Marine	Sande	3510	1.500	Diesel	B
7271	1799	Ancon Marine	Sande	3510	1.500	Diesel	B
7271	1799	Ancon Marine	Sande	3510	1.500	Diesel	B
7271	1799	Ancon Marine	Sande	3510	1.500	Diesel	B
0428	8211	Cabrillo Middle School	Ajax	SGX1750	1.750		B
0238	8221	Cal State University	Ajax	SGX1500D	1.500		B
0041	1311	CalResources - Ventura	Superior		1.000		H
0041	1311	CalResources - Ventura	National		1.500		H
0041	1311	CalResources - Ventura	B, S & B		1.400		H
1295	6512	Camarillo Business Center	Ajax	WGB1750	1.750		B
0554	7011	Casa Sirena Hotel	Teledyne Laars	SL1466D-N01B	1.466		B
0846	7011	Courtyard by Marriott	Teledyne Laars	82-35075	1.825		B
0846	7011	Courtyard by Marriott	Teledyne Laars	VW1825IW09K	1.825		B
0294	7011	Doubletree	Lochinvar	CFN1800	1.800		B
0294	7011	Doubletree	Lochinvar	CFN1800	1.800		B
0294	7011	Doubletree	Lochinvar	CFN1800	1.800		B
0294	7011	Doubletree	Lochinvar	CFN1800	1.800		B
0294	7011	Doubletree	Lochinvar	CFN1800	1.800		B
0294	7011	Doubletree	Lochinvar	CFN1800	1.800		B
7008	6512	Earl Stanley Gardner	Ajax	SGX1500S	1.500		B
7289	1799	Ecology Control	Sande	3510	1.500	Diesel	B
7289	1799	Ecology Control	Sande	3510	1.500	Diesel	B
7289	1799	Ecology Control	Sande	3510	1.500	Diesel	B
7289	1799	Ecology Control	Sande	3510	1.500	Diesel	B
7289	1799	Ecology Control	Sande	3510	1.500	Diesel	B
0977	1311	GEO Petroleum	Petrotherm		2.000		B
0993	1311	GEO Petroleum	Trico Superior		1.000		H
0363	1311	Joro, Inc.	Parkersberg		1.000		H
0818	6512	Lincoln Property Company	Ajax	WGX2000D	2.000		H
0429	8211	Loma Vista Elem. School	National	AC4260	1.750		B
0429	8211	Loma Vista Elem. School	National	AC4260	1.750		B
0509	7011	Ojai Valley Inn & C. C.	Ajax	WGH2000S	2.000		B
0509	7011	Ojai Valley Inn & C. C.	Ajax	WGH1500S	1.500		B
1043	8222	Oxnard College	Rite		1.800		B
7235	1389	Philip West Industrial Serv.	Parker	T1730	1.700		P
0227	3272	Pre-Con Products	Parker		1.080		B
0553	3365	Precision Microcast	McKenna	35	1.500		B
0388	1311	Seneca Resources	Natco		1.750		H
0520	3674	Siemens Solar Industries	Raypak	E1758T-O	1.800		H
0150	4952	Thousand Oaks WWTP	Heatx	EB	1.500		H
0003	1311	Torch Operating - Rincon	Natco		1.000		H
0003	1311	Torch Operating - Rincon	Parker	T1460	1.460		H
0999	9711	US Navy - NAWS	Hurst	S45C375-30W	1.600	LoNOx	B
0999	9711	US Navy - NAWS - Bldg #3008	Ajax	WGOFD1050	1.050		B

File	SIC	Company	Mfgr.	Model Number	Size	Burner	Type
0999	9711	US Navy - NAWS - Bldg #375	Ajax	WGFD1050	1.050		B
1003	9711	US Navy - NFESC Bldg #560	Lattner		1.150		B
1012	9711	US Navy - NCBC	Ajax	WG1750	1.750		B
1012	9711	US Navy - NCBC	Rite	WGO	1.800		B
1012	9711	US Navy - NCBC	Rite	WGO	1.800		B
1012	9711	US Navy - NCBC	Kewanee	M155KGO	1.630		B
1012	9711	US Navy - NCBC - Bldg #813	York Shipley	SPWV30N2	1.000		B
0994	9111	VC GSA - Foster Library	Bryan	CU120WWTGI	1.080	LoNOx	B
1011	9111	VC GSA - PSSA		EI414T-0	1.413	LoNOx	B
1018	9223	VC GSA - Work Furlough		CL120WTLP	1.200		B
1299	9223	VC GSA - Todd Road Jail	Lochinvar	PBN-1000	1.000	LoNOx	B
1299	9223	VC GSA - Todd Road Jail	Lochinvar	PFN-1000	1.000	LoNOx	B
1299	9223	VC GSA - Todd Road Jail	Lochinvar	PFN-1000	1.000	LoNOx	B
1299	9223	VC GSA - Todd Road Jail	Lochinvar	PBN-1000	1.000	LoNOx	B
1299	9223	VC GSA - Todd Road Jail	Lochinvar	PFN-1000	1.000	LoNOx	B
0126	8222	Ventura College	Raypac	H2100	1.990		B
0126	8222	Ventura College	Raypac	W1826	1.825		B
1390	9111	Ventura County Facilities	Peerless	211A09W-HSP	1.500	LoNOx	H
0432	8211	Ventura High School	Ajax	SGX1750	1.750		B
0432	8211	Ventura High School	Ajax	SGX1750	1.750		B
0432	8211	Ventura High School	Ajax	SXG1750	1.750		B
0053	1311	Vintage Petroleum - S Mtn	B, S & B		1.000		H
0008	1311	Vintage Petroleum-Rincon	B, S & B		2.000		L
7227	1799	Waste Management	Sande	3510	1.500	Diesel	B

Legend:
SIC - Standard Industrial Classification Code
Type - B = Boiler, H = Heater Treater, P = Process Heater

Appendix E
Cost-Effectiveness Calculations

General Assumptions

Natural Gas Cost = $0.521 per therm
Capacity Factor = 12 percent (0.12)
Capital Recovery Factor = 0.149 (10 year life at 8% interest)

135,000 BTU/hr Atmospheric to Forced-draft Gas-fired Unit

Assumptions

Fuel Savings = 10 percent
Capital cost of standard **atmospheric** unit - $1695
New Unit = Very Low-NOx 135,000 BTU/hr **forced-draft** unit- $2560
Uncontrolled emission rate = 115 ppmv (0.137 lb/MMBTU)
Controlled emission rate = 9.9 ppmv (0.012 lb/MMBTU)
Cost for 0.5 HP forced-draft fan electricity = $34 per year

Emission Reduction

Emission rate reduction: (0.137 lb/MMBTU)-(0.012 lb/MMBTU) = 0.125 lb/MMBTU
(0.135 MMBTU/hr)*(0.125 lb/MMBTU)*(8760 hr/yr)/(2000 lb/ton)*(.12) = 0.009 Tons/yr NOx reduced

Annual Cost

($2560 for low-NOx)-($1695 for standard) = $865 (.149 CRF) = $129 annual cost differential

Fuel Cost: ($0.521/Therm)(135,000 BTU/hr)(8760 hr/yr)(1 therm/100,000 BTU)(.12) = $739/yr
Fuel Savings = ($739/yr)(.10) = $74 saved annually

Cost Effectiveness: ($129/yr)-($74.00)+($34) = $89/0.009 Tons NOx = **$9889 / Ton of NOx reduced**

150,000 BTU/hr Atmospheric to Atmospheric Gas-fired Unit (Average)

Assumptions
Fuel Savings = None
Capital cost of standard **atmospheric** unit - $2129 average
New Unit = low-NOx 150,000 BTU/hr **atmospheric** unit (add 10%) - $2342
Uncontrolled emission rate = 115 ppmv (0.137lb/MMBTU)
Controlled emission rate = 55 ppmv (0.065 lb/MMBTU)

Emission Reduction
Emission rate reduction: (0.137 lb/MMBTU)-(0.065 lb/MMBTU) = 0.072 lb/MMBTU
(0.15 MMBTU/hr)*(0.072 lb/MMBTU)*(8760 hr/yr)/(2000 lb/ton)*(.12) = 0.006 Tons/yr NOx reduced

Annual Cost
($2342 for low-NOx)-($2129 for standard) = $213 (.149 CRF) = $32 annual cost differential

Cost Effectiveness: ($32/yr)/(0.006 Tons NOx) = **$5333 / Ton of NOx reduced**

300,000 BTU/hr Atmospheric to Forced-draft Gas-fired Unit

Assumptions
Fuel Savings = 10 percent
Capital cost of standard **atmospheric** unit - $2475
New Unit = Very Low-NOx 300,000 BTU/hr **forced-draft** unit- $4606
Uncontrolled emission rate = 115 ppmv (0.137 lb/MMBTU)
Controlled emission rate = 9.9 ppmv (0.012 lb/MMBTU)
Cost for 0.5 HP forced-draft fan electricity = $34 per year

Emission Reduction
Emission rate reduction: (0.137 lb/MMBTU)-(0.012 lb/MMBTU) = 0.125 lb/MMBTU
(0.3 MMBTU/hr)*(0.125 lb/MMBTU)*(8760 hr/yr)/(2000 lb/ton)*(.12) = 0.020 Tons/yr NOx reduced

Annual Cost
($4606 for low-NOx)-($2475 for standard) = $2131 (.149 CRF) = $318 annual cost differential

Fuel Cost: ($0.521/Therm)(300,000 BTU/hr)(8760 hr/yr)(1 therm/100,000 BTU)(.12) = $1643/yr
Fuel Savings = ($1643/yr)(.10) = $164 saved annually

Cost Effectiveness: ($318/yr)-($164.00)+($34) = $188/0.020 Tons NOx = **$9400 / Ton of NOx reduced**

400,000 BTU/hr Forced-draft to Forced-draft Gas-fired Unit

Assumptions
Fuel Savings = None
Capital cost of standard **forced-draft** unit - $5880
New Unit = Complying same brand **forced-draft** unit (30% more) - $8400
Uncontrolled emission rate = 143 ppmv (0.17 lb/MMBTU)
Controlled emission rate = 30 ppmv (0.035 lb/MMBTU)

Emission Reduction
Emission rate reduction: (0.17 lb/MMBTU)-(0.035 lb/MMBTU) = 0.135 lb/MMBTU
(0.4 MMBTU/hr)*(0.135 lb/MMBTU)*(8760 hr/yr)/(2000 lb/ton)*(.12) = 0.028 Tons/yr NOx reduced

Annual Cost
($8400 for low-NOx)-($5880 for standard) = $2520 (.149 CRF) = $375 annual cost differential

Cost Effectiveness: ($375/yr)/(0.028 Tons NOx) = **$13,393 / Ton of NOx reduced**

500,000 BTU/hr Atmospheric to Forced-draft Gas-fired Unit

Assumptions
Fuel Savings = 10 percent
Capital cost of standard **atmospheric** unit - $3458
New Unit = Very Low-NOx 300,000 BTU/hr **forced-draft** unit - $6625
Uncontrolled emission rate = 143 ppmv (0.17 lb/MMBTU)
Controlled emission rate = 9.9 ppmv (0.012 lb/MMBTU)
Cost for 0.75 HP forced-draft fan electricity = $38 per year

Emission Reduction
Emission rate reduction: (0.17 lb/MMBTU)-(0.012 lb/MMBTU) = 0.158 lb/MMBTU
(0.3 MMBTU/hr)*(0.158 lb/MMBTU)*(8760 hr/yr)/(2000 lb/ton)*(.12) = 0.025 Tons/yr NOx reduced

Annual Cost
($6625 for low-NOx)-($3458 for standard) = $3167 (.149 CRF) = $472 annual cost differential

Fuel Cost: ($0.521/Therm)(500,000 BTU/hr)(8760 hr/yr)(1 therm/100,000 BTU)(.12) = $2738/yr
Fuel Savings = ($2738/yr)(.10) = $274 saved annually

Cost Effectiveness: ($472/yr)-($274.00)+($38) = $236/0.025 Tons NOx = **$9440 / Ton of NOx reduced**

750,000 BTU/hr Atmospheric to Forced-draft Gas-fired Unit

Assumptions
Fuel Savings = 10 percent
Capital cost of standard **atmospheric** unit - $5409
New Unit = Very low-NOx **forced-draft** unit- $11,760
Uncontrolled emission rate = 143 ppmv (0.17 lb/MMBTU)
Controlled emission rate = 9.9 ppmv (0.012 lb/MMBTU)
Cost for 1.0 HP forced-draft fan electricity = $51 per year

Emission Reduction
Emission rate reduction: (0.17 lb/MMBTU)-(0.012 lb/MMBTU) = 0.158 lb/MMBTU
(0.75 MMBTU/hr)*(0.158 lb/MMBTU)*(8760 hr/yr)/(2000 lb/ton)*(.12) = 0.062 Tons/yr NOx reduced

Annual Cost
($11,760 for low-NOx)-($5409 for standard) = $6351 (.149 CRF) = $946 annual cost differential

Fuel Cost: ($0.521/Therm)(750,000 BTU/hr)(8760 hr/yr)(1 therm/100,000 BTU)(.12) = $4108/yr
Fuel Savings = ($4108/yr)(.10) = $411 saved annually

Cost Effectiveness: ($946/yr)-($411.00)+($51) = $586/0.062 Tons NOx = **$9452 / Ton of NOx reduced**

90,000 BTU/hr Atmospheric Gas-fired Unit to Electric Unit

Assumptions
90,000 BTU/hr gas fired unit equivalent to a 25 KW electric unit
Electricity Cost = $0.0654 per KW-hr
Fuel Savings = 100 percent
Capital cost of standard **atmospheric** unit - $1686
New Unit = 25 KW **electric** unit- $1900
Uncontrolled emission rate = 115 ppmv (0.137 lb/MMBTU)
Controlled emission rate = Zero (power plant emissions negligible)

Emission Reduction

Emission rate reduction: 0.137 lb/MMBTU
(0.09 MMBTU/hr)*(0.137 lb/MMBTU)*(8760 hr/yr)/(2000 lb/ton)*(.12) = 0.006 Tons/yr NOx reduced

Annual Cost

($1900 for electric)-($1686 for standard) = $214 (.149 CRF) = $32 annual cost differential

Fuel Savings = ($0.521/Therm)(90,000 BTU/hr)(8760 hr/yr)(1 therm/100,000 BTU)(.12) = $493/yr
Electricity Cost: (25 KW)($0.0654/KW-hr)(8760 hr/yr)(.12) = $1719/yr

Cost Effectiveness: ($32/yr)-($493)+($1719) = $1258/0.006 T NOx = **$209,667 / Ton of NOx reduced**

1,000,000 BTU/hr Forced-Draft Gas-fired Unit to Electric Unit

Assumptions
1,000,000 BTU/hr gas fired unit equivalent to a 300 KW electric unit
Electricity Cost = $0.0654 per KW-hr
Fuel Savings = 100 percent
Capital cost of standard **forced-draft** unit - $8500 (estimate)
New Unit = 300 KW **electric** unit- $14,958
Uncontrolled emission rate = 143 ppmv (0.17 lb/MMBTU)
Controlled emission rate = Zero (power plant emissions negligible)

Emission Reduction

Emission rate reduction: 0.17 lb/MMBTU
(1.0 MMBTU/hr)*(0.17 lb/MMBTU)*(8760 hr/yr)/(2000 lb/ton)*(.12) = 0.089 Tons/yr NOx reduced

Annual Cost

($14,958 for electric)-($8500 for standard) = $6458 (.149 CRF) = $962 annual cost differential

Fuel Savings = ($0.521/Therm)(1,000,000 BTU/hr)(8760 hr/yr)(1 therm/100,000 BTU)(.12) = $5477/yr
Electricity Cost: (300 KW)($0.0654/KW-hr)(8760 hr/yr)(.12) = $20,625/yr

Cost Effectiveness: ($962/yr)-($5477)+($20,625) = $16,110/0.089 T NOx = **$181,014 / Ton of NOx reduced**

90,000 BTU/hr Atmospheric Gas-fired Unit to Heat Recovery Water Heater

Assumptions
90,000 BTU/hr gas fired unit equivalent to a 25 ton A/C or Refrigeration system
Fuel Savings = 100 percent
Capital cost of standard **atmospheric** unit - $1686
25 ton **heat recovery** unit = $2005 + 50% for installation = $3008
Uncontrolled emission rate = 115 ppmv (0.137 lb/MMBTU)
Controlled emission rate = Zero

Emission Reduction

(0.09 MMBTU/hr)*(0.137 lb/MMBTU)*(8760 hr/yr)/(2000 lb/ton)*(.12) = 0.006 Tons/yr NOx reduced

Annual Cost

($3008 for electric)-($1686 for standard) = $1322 (.149 CRF) = $197 annual cost differential

Fuel Savings = ($0.521/Therm)(90,000 BTU/hr)(8760 hr/yr)(1 therm/100,000 BTU)(.12) = $493/yr

Cost Effectiveness: ($197/yr)-($493) = $(-) 296/0.006 T NOx = **$(-) 49,333 / Ton of NOx reduced**

350,000 BTU/hr Forced-Draft Gas-fired Unit to Gas-fired & Heat Recovery Water Heater

Assumptions
350,000 BTU/hr gas fired unit equivalent to a 50 ton A/C or Refrigeration system and
a 150,000 BTU/hr gas-fired water heater
Fuel Savings = 50 percent
Capital cost of standard **forced-draft** unit = $5880
50 ton **heat recovery** unit = $3475 + 50% for installation = $5213
Capital cost of additional low-NOx 150,000 BTU/hr **atmospheric** unit = $2342
Uncontrolled emission rate = 143 ppmv (0.17 lb/MMBTU)
Controlled emission rate = 55 ppmv (0.07 lb/MMBTU)

Emission Reduction
Old Situation
(0.35 MMBTU/hr)*(0.17 lb/MMBTU)*(8760 hr/yr)/(2000 lb/ton)*(.12) = 0.031 Tons/yr NOx
New Situation
(0.15 MMBTU/hr)*(0.07 lb/MMBTU)*(8760 hr/yr)/(2000 lb/ton)*(.12) = 0.006 Tons/yr NOx
Difference = (0.031)-(0.006) = 0.025
Annual Cost

($5213 for HR unit)+(2342 for low-NOx)-($5800 for standard) = $1755 (.149 CRF) = $261 annual cost differential

Fuel Use - Old Situation
($0.521/Therm)(350,000 BTU/hr)(8760 hr/yr)(1 therm/100,000 BTU)(.12) = $1917 /yr
Fuel Use - New Situation
($0.521/Therm)(200,000 BTU/hr)(8760 hr/yr)(1 therm/100,000 BTU)(.12) = $1095 /yr
Difference = (1917)-(1095) = $822

Cost Effectiveness: ($261)-($822) = $(-) 561/0.025 T NOx = **(-) $22,440 / Ton of NOx reduced**

400,000 BTU/hr Forced-Draft Gas-fired Unit to Heat Recovery Water Heater

Assumptions
400,000 BTU/hr gas fired unit equivalent to a 90 ton A/C or Refrigeration system
Fuel Savings = 100 percent
Capital cost of standard **forced-draft** unit = $5880
90 ton **heat recovery** unit = $5875 + 50% for installation = $8813
Uncontrolled emission rate = 143 ppmv (0.17 lb/MMBTU)
Controlled emission rate = Zero

Emission Reduction

(0.4 MMBTU/hr)*(0.17 lb/MMBTU)*(8760 hr/yr)/(2000 lb/ton)*(.12) = 0.036 Tons/yr NOx reduced

Annual Cost

($8813 for HR unit)-($5800 for standard) = $3013 (.149 CRF) = $449 annual cost differential

Fuel Savings = ($0.521/Therm)(400,000 BTU/hr)(8760 hr/yr)(1 therm/100,000 BTU)(.12) = $2191 /yr

Cost Effectiveness: ($449)-($2191) = $(-)1742/0.036 T NOx = **(-) $48,389 / Ton of NOx reduced**

750,000 BTU/hr Atmospheric Gas-fired Unit to Heat Recovery Water Heater

Assumptions
750,000 BTU/hr gas fired unit equivalent to a 180 ton A/C or Refrigeration system
Fuel Savings = 100 percent
Capital cost of standard **forced-draft** unit = $5409
180 ton **heat recovery** unit = $10,950 + 50% for installation = $16,425
Uncontrolled emission rate = 143 ppmv (0.17 lb/MMBTU)
Controlled emission rate = Zero

Emission Reduction

(0.75 MMBTU/hr)*(0.17 lb/MMBTU)*(8760 hr/yr)/(2000 lb/ton)*(.12) = 0.067 Tons/yr NOx reduced

Annual Cost

($16,425 for HR unit)-($5409 for standard) = $11,016 (.149 CRF) = $1641 annual cost differential

Fuel Savings = ($0.521/Therm)(750,000 BTU/hr)(8760 hr/yr)(1 therm/100,000 BTU)(.12) = $4108 /yr

Cost Effectiveness: ($1641)-($4108) = $(-)2467/0.067 T NOx = **(-) $36,821 / Ton of NOx reduced**

Appendix F
Ventura County APCD
Operating Permit Program Rules
(as of August 31, 1999)

Permit Rules		Latest Version
Rule 10	Permits Required	6/13/95
Rule 11	Definitions for Regulation II	6/13/95
Rule 12	Applications for Permits	6/13/95
Rule 13	Action on Applications for an Authority to Construct	6/13/95
Rule 14	Action on Applications for a Permit to Operate	6/13/95
Rule 15	Standards for Permit Issuance	6/13/95
Rule 15.1	Sampling and Testing Faclities	10/12/93
Rule 16	BACT Certification	6/13/95
Rule 19	Posting of Permits	5/23/72
Rule 20	Transfer of Permit	5/23/72
Rule 22	Appeals	6/13/95
Rule 23	Exemptions from Permit	7/9/96
Rule 24	Source Recordkeeping, Reporting and Emission Statements	9/15/92
Rule 27	Suspension of Permits	3/9/76
Rule 28	Revocation of Permits	7/18/72
Rule 29	Conditions on Permits	10/22/91
Rule 30	Permit Renewal	5/30/89
Rule 31	Public Disclosure of Data	11/22/77
Rule 32	Breakdown Conditions: Emergency Variances	2/20/79
TITLE V RULE:		
Rule 33	Part 70 Permits - General	10/12/93
Rule 33.1	Part 70 Permits - Definitions	10/12/93
Rule 33.2	Part 70 Permits - Application Contents	10/12/93
Rule 33.3	Part 70 Permits - Permit Content	10/12/93
Rule 33.4	Part 70 Permits - Operational Flexibility	10/12/93
Rule 33.5	Part 70 Permits - Timeframes for Applications, Review and Issuance	10/12/93
Rule 33.6	Part 70 Permits - Permit Term and Permit Reissuance	10/12/93
Rule 33.7	Part 70 Permits - Notification	10/12/93
Rule 33.8	Part 70 Permits - Reopening of Permits	10/12/93
Rule 33.9	Part 70 Permits - Compliance Provisions	10/12/93
Rule 33.10	Part 70 Permits - General Part 70 Permits	10/12/93
Rule 35	Elective Emission Limits	11/12/96
Rule 36	New Source Review – Hazardous Air Pollutants	10/6/98
Rule 76	Federally Enforceable Limits on Potential to Emit	10/10/95